

Interdisciplinary Journal of Virtual
Learning in Medical Sciences
(IJVLMS)

***Interdisciplinary Journal of
Virtual Learning in Medical Sciences
(IJVLMS)***

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JOURNAL INFORMATION

▶ AIMS AND SCOPE

Interdisciplinary Journal of Virtual Learning in Medical Sciences (IJVLMS) aims at promoting and enhancing the quality of e-learning in formal and non-formal education. IJVLMS publishes research and scholarly articles concerned with electronic education and distance learning. The journal accepts Original Articles, Reviews, Special Reports, Brief Reports, Short Communications, News, Software Article, Commentaries and Letters to the Editor. Papers in the following areas will be considered for publication:

Online learning and distance education

Studying current trends and future developments in open, distance, blended, and distributed learning, and online education.

Emerging technologies in learning

Evaluating new technologies developed to enhance the learning process ranging from internet and web-based applications, to collaborative software, Intelligent Tutoring System, Artificial Intelligence, machine learning, Virtual Reality, Augmented Reality, simulation, etc.

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Designing and implementing effective instructional modules and curriculums that can be applied in virtual settings and meet the learners' concerns and preferences.

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Looking into the impacts of digital learning on people's lives and outlooks and the new opportunities it presents to different communities around the world.

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The aims of the journal with regards to the mentioned areas include:

- Creating the basis for the promotion of knowledge and research in e-learning
- Publishing research articles and analytical presentations in order to advance the production of scientific knowledge
- Advocating electronic learning in higher education
- Encouraging researchers to expand scientific research in the field of e-learning
- Creating suitable foundations for exchanging information on e-learning
- Introducing academics and experts in virtual education and publishing their findings
- Developing and promoting e-learning programs in medical education

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Uncovering the Complexities of Intubation in Covid-19 Patients to Enhance Online Teaching: A Literature Review

Kamelia Ghajarzadeh^{1*}, PhD;  Kamyar Azhdari², PhD

¹Department of Anesthesia, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

²Department of Plastic Surgery, AJA University of Medical Sciences, Imam Reza Hospital, Tehran, Iran

ABSTRACT

Background: Intubation is a crucial procedure used to maintain an open airway in patients who are deeply sedated, unconscious, or under anesthesia. It enables controlled ventilation and administration of oxygen during surgeries, severe illnesses, extensive trauma, or following cardiac arrest. Difficult intubation poses a significant risk to patients' well-being and necessitates comprehensive training programs for healthcare providers. With the rise of online teaching, it is essential to explore and understand the complications associated with difficult intubation to develop effective online training programs.

Methods: A literature review was conducted to examine the relevant literature on intubation complications and online teaching approaches. Electronic databases, including PubMed, Embase, and Scopus, were searched using keywords such as "intubation complications", "difficult airway", "online teaching", and related terms. Studies published from January 2018 to September 2022 were included. The selection criteria focused on articles that addressed the complications of intubation, online teaching strategies, and their impact on healthcare provider training.

Results: The literature review identified 23 relevant studies that met the inclusion criteria. The findings highlighted the significance of understanding and addressing the complications associated with difficult intubation in online teaching programs. Various approaches were explored, including virtual simulations, video-based modules, and interactive online platforms. These methods demonstrated promising results in improving healthcare providers' knowledge and skills related to intubation, ultimately enhancing the patients' safety.

Conclusion: This literature review emphasizes the importance of integrating the complications of difficult intubation into online teaching programs for healthcare providers. The findings support the utilization of virtual simulations, video-based modules, and interactive online platforms as effective tools in enhancing training outcomes. Online teaching provides a flexible and accessible platform for healthcare providers to learn and practice intubation techniques in a simulated environment, thus improving their preparedness for real-life scenarios.

Keywords: Intubation, Ventilation, Corona, Patient, General Anesthesia, Online Teaching

*Corresponding author:

Kamelia Ghajarzadeh, PhD;
Department of Anesthesia,
School of Medicine, Iran
University of Medical Sciences,
Tehran, Iran

Email: kamighajar97@gmail.com

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Introduction

Covid-19, as a contagious disease, is one of the common diseases between humans and animals, which is caused by the coronavirus family, which is one of the RNA viruses (1-3). The Covid-19 virus is one of the most dangerous viruses in this family. According to the report of the World Health Organization, until June 2020, about 6.5 million people were infected all over the world and more than 390 thousand deaths due to this disease were reported. Iran is the 25th country which was infected with this virus (4-6). In Wuhan, China, the mean age of those who died was 50 years, and the number of reports was higher in men. Approximately 81% of patients had mild symptoms, and only 14% of them had severe symptoms including pneumonia and shortness of breath. About 5% of severe cases faced respiratory failure, infectious shock, and failure of other body organs. Fever and cough were reported as the most common symptoms, especially in children (7-10).

In the study by Chen et al., the incidence rate was slightly higher in men. Of course, in the study by Lee et al., the incidence rate was higher in women. Previous studies showed that in deceased patients, the age above 60 years accounted for more deaths (11-13). Due to the fact that elderly people are more prone to death and the presence of underlying diseases among elderly is higher, these people suffer increased risk of death (14). The decrease in the consciousness level was significantly higher in the deceased. Paying attention to the clinical signs and symptoms of the patients who died shows that these

patients had serious conditions upon arrival. The checking blood oxygen saturation shows that most of these patients had spo2 lower than 93% (15-17).

Given that Covid-19 shows more deterioration in people with underlying diseases such as blood pressure, and that these patients are more at risk of coagulation and thromboembolism problems during long-term hospitalization, using vasoconstrictor drugs in Covid-19 patients is of utmost importance (Figure 1).

As to blood products injection, although a small percentage of patients required blood products injection, long-term hospitalization in the intensive care unit alone is a factor in causing anemia in patients; thus, the availability of blood products and the safety of injection should be more considered (18-20). The Covid-19 pandemic represents the most extensive global public health crisis (21, 22). Intubation is necessary when the airways are obstructed or damaged or when breathing is not possible. Intubation plays a crucial role in the management of Covid-19 patients with severe respiratory distress. When the disease progresses to a critical stage, some individuals may experience acute respiratory failure and require mechanical ventilation for their survival. Intubation involves the insertion of an endotracheal tube into the patient's airway to maintain an open pathway for oxygen delivery and removal of carbon dioxide (23). In Covid-19 cases, intubation presents unique challenges due to the highly contagious nature of the virus and the need for strict infection control measures.

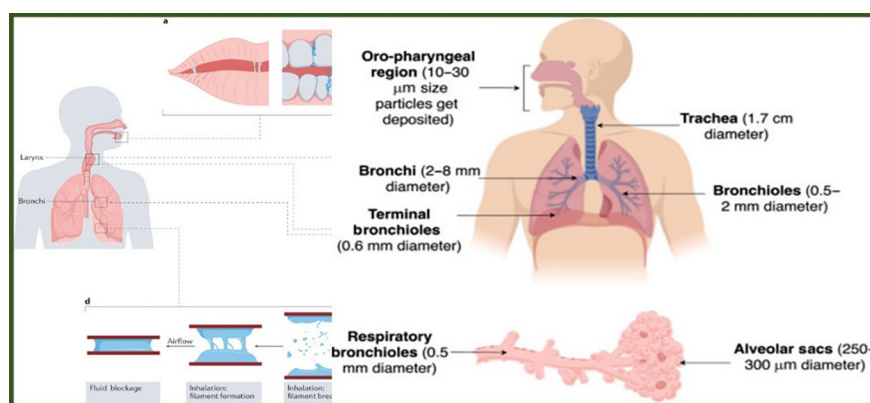


Figure 1: Exhalation and deposition of particles

Healthcare professionals must use personal protective equipment (PPE) to minimize the risk of transmission during the intubation procedures. Additionally, specific precautions such as using a negative pressure room and minimizing the number of healthcare workers involved are implemented to safeguard the healthcare team (24).

Online teaching on intubation in Covid-19 patients has emerged as a crucial educational approach amidst the global pandemic. With the need for healthcare professionals to quickly adapt to new protocols and guidelines, virtual platforms have become invaluable tools for disseminating knowledge and ensuring patient safety. Through online teaching, healthcare providers can access comprehensive training materials, interactive simulations, and real-time demonstrations, all designed to enhance their understanding and proficiency in intubating Covid-19 patients. These virtual sessions enable the participants to learn from experts in the field, engage in collaborative discussions, and address common challenges encountered during intubation procedures. Online teaching not only offers flexibility in terms of time and location, but also promotes continuous learning and skill development, ultimately improving the patient outcomes in the face of this unprecedented healthcare crisis (25).

The ultimate goal of the study is to enhance online teaching by providing evidence-based recommendations and educational resources that address the complexities of intubation in Covid-19 patients. By improving the understanding of these complications, healthcare professionals and educators can effectively train and prepare healthcare providers to manage intubation procedures in Covid-19 sufferers, leading to improved patient outcomes and overall healthcare quality. As the pandemic has forced many healthcare professionals to shift to online teaching and training, it is crucial to explore the complications of intubation in Covid-19 patients to inform effective online teaching strategies. This literature review aims to explore the existing literature on the

complications of intubation in Covid-19 patients and their implications for online teaching, with the goal of improving patient outcomes and supporting healthcare providers in the face of this global health crisis.

Methods

As to the research objectives of this study, firstly the literature review aimed to clearly state its objectives, which are threefold. The first objective was to identify and understand the complexities associated with intubation in Covid-19 patients. This involves exploring the challenges, risks, and unique considerations that arise when performing intubation procedures on individuals infected with the Covid-19 virus.

The second objective was to assess the effectiveness and adequacy of the existing online teaching methods used for intubation training. This entails examining various instructional approaches, virtual platforms, and educational resources utilized in teaching healthcare professionals the skills required for successful intubation. The goal was to evaluate their strengths, weaknesses, and overall suitability in the context of online learning.

Lastly, the literature review sought to propose strategies for enhancing online teaching methods to effectively address the complexities of intubation. Based on the findings of the previous objectives, this objective aimed to recommend innovative approaches, instructional techniques, and technological advancements that can improve the quality and comprehensiveness of online intubation training. The ultimate aim was to develop practical and efficient solutions that can better prepare healthcare professionals to tackle the challenges posed by intubation in Covid-19 cases.

Study Selection Criteria

The study selection criteria for this research consist of both inclusion and exclusion criteria. The inclusion criteria were the articles published in peer-reviewed journals and academic conferences to

ensure their credibility and adherence to rigorous evaluation processes; the studies published between 2019 and 2023; studies with the focus specifically on the Covid-19 pandemic in order to ensure relevance to the current context; articles written in English to facilitate comprehension and accessibility for the research team; and studies that provide insights into the complexities of intubation in Covid-19 patients or discuss online teaching methods for intubation training. Non-peer-reviewed articles, book chapters, and editorials were excluded to maintain a high standard of quality and reliability.

Data Sources

A variety of data sources were employed for this research. The primary databases used for literature search included PubMed, Scopus, Web of Science, and Google Scholar. These databases are renowned for their comprehensive coverage of scholarly articles and research publications. In addition to these databases, relevant professional association websites were consulted to access resources and guidelines from experts in the field. Moreover, gray literature repositories were considered as an additional source, allowing for the inclusion of non-traditional research outputs such as reports and conference proceedings. By utilizing this diverse range of data sources, the research aimed to gather a wide range of information and perspectives to ensure a comprehensive analysis of the topic at hand.

Search Strategy

To conduct a thorough literature search, we developed a comprehensive search strategy. The strategy involved utilizing a combination of keywords and search terms, including variations and synonyms, to ensure a wide coverage of relevant literature. The key terms included “Covid-19”, “SARS-CoV-2”, “intubation”, “airway management”, “respiratory support”, “online teaching”, “virtual education”, and “simulation-based training.” By incorporating these terms, the search aimed to find the studies and articles

that addressed the complexities of intubation in Covid-19 patients and explored online teaching methods for intubation training. The inclusion of variations and synonyms expanded the search scope, enabling a more comprehensive retrieval of pertinent literature for the research.

Study Selection Process

The study selection process involved an approach to ensure the inclusion of relevant articles while maintaining consistency with the predetermined criteria. Initially, articles were screened based on their titles and abstracts to assess their potential relevance. Subsequently, the full-text articles that passed the initial screening were carefully evaluated against the established inclusion and exclusion criteria. This comprehensive review process was conducted by two independent reviewers who assessed the articles for their alignment with the research objectives. Any discrepancies or disagreements between the reviewers were resolved through discussion and consensus. By employing this rigorous study selection process, the research aimed to ensure the inclusion of high-quality and pertinent articles in the final analysis.

Data Extraction

A standardized data extraction form was developed to facilitate the collection of relevant information from the selected studies. The form ensured consistency in data extraction by capturing key details from each study. This included information such as the author(s), publication year, and study design to provide a clear understanding of the study’s background. Methodological details, including the participant characteristics if applicable, were recorded to gain insights into the approach of the study. The data extraction form also focused on extracting the key findings related to the complexities of intubation in Covid-19 patients, providing a comprehensive overview of the challenges, risks, and unique considerations identified in the literature. Additionally, the form captured details about online teaching methods,

their effectiveness, and any limitations or recommendations provided by the authors. By utilizing this standardized approach, the researchers aimed to gather essential information for further analysis and synthesis.

The utilization of a standardized data extraction form ensured consistency and accuracy in capturing the necessary information from the selected studies. The form facilitated the organization and categorization of the literature by extracting details such as author(s), publication year, and study design. Furthermore, the form allowed for the recording of methodology and participant information, enabling a comprehensive understanding of the research approaches employed. The extraction form also focused on key findings pertaining to the complexities of intubation in Covid-19 patients, shedding light on important insights from the literature. Additionally, by documenting the description and effectiveness of online teaching methods, as well as limitations and recommendations provided by the authors, the data extraction form enabled a comprehensive analysis of the current state of knowledge in this area.

Data Analysis

The data analysis phase of the research

employed thematic analysis as the chosen approach. Thematic analysis involved identifying recurring themes and sub-themes within the extracted data from the selected studies. The data, including key findings, information on online teaching methods, and limitations/recommendations were organized and categorized based on these identified themes. By structuring the data in this way, patterns, similarities, and discrepancies across the studies were examined and analyzed. This process aimed to derive meaningful insights and generate a comprehensive understanding of the complexities of intubation in Covid-19 patients and the effectiveness of online teaching methods for intubation training. The results of the analysis were then interpreted to draw conclusions and contribute to the research objectives (Figure 2).

Results

Complexities Associated with Intubation in Covid-19 Patients

Intubation and being on a ventilator are related but not exactly the same. Intubation is the process of placing an endotracheal tube (ETT) into the trachea. The tube is then connected to a device that delivers the air (26, 27). This device can be a bag that the doctor inflates to get the air into your body,

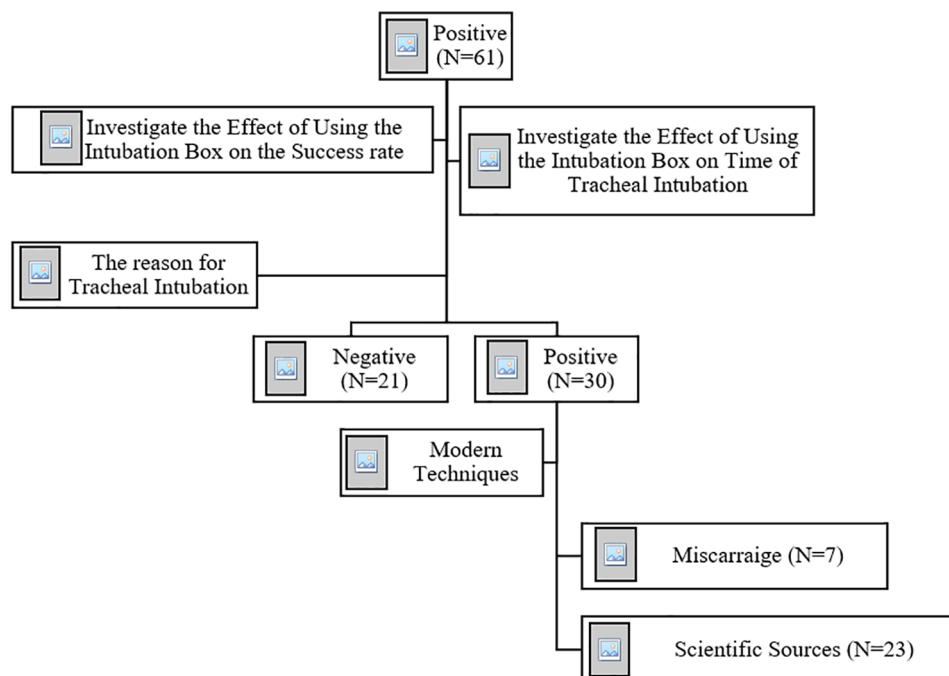


Figure 2: Flow chart of the included subjects

or it can be a ventilator, a device that delivers oxygen to your airways and lungs. Sometimes a ventilator delivers air to the person through a mask instead of a tube. In some cases, doctors decide that intubation is not safe, such as when there is severe trauma to the airway or when there is an obstruction that makes safe placement of the tube impossible. In such cases, doctors may decide to open an airway in the person's throat in the lower part of the neck (28).

The Goals of Repentance

The following can be considered for the purposes of repentance:

- 1- Opening the airway to inject oxygen and anesthesia to the patient;
- 2- Removing the obstruction of the lungs;
- 3- Helping the patient to breathe in case of lung collapse or heart failure;
- 4- Diagnosing airway obstruction by the doctor;
- 5- Avoiding liquid consumption by patients (28).

Specialties related to intubation include Cardiology, neurology, pulmonary medicine, internal medicine, pediatrics, neurology, and traumatology. Intubation varies depending on the purpose and type in the operating room or in the emergency setting. In the operating room or other controlled environments, the doctor uses anesthesia to put the person to sleep. He then places an instrument called a laryngoscope into the person's mouth to insert a flexible tube. If the doctor faces vision problems at the time of diagnosis, he can insert a small camera into the person's body for guidance. In the operating room, doctors often use intubation to help a person under anesthesia. Emergency intubation carries certain risks due to high blood pressure, and for this reason the person may not be as stable as someone in the operating room (29, 30).

Stages of Repentance

Most transplants are done in the hospital. Sometimes EMS treats people outside of the hospital setting. During this process, healthcare providers do the following for intubation: An IV needle is inserted into

the arm. Medicines are given through an IV for pain relief as needed. An oxygen mask is placed over the nose and mouth to give a little more oxygen to the body. In the next step, the mask is removed and the patient's head is tilted back, and the laryngoscope is inserted into the mouth (or sometimes the nose if needed) (30, 31). The device is moved to the back of the mouth and away from the teeth. A tracheostomy is a raised flap of tissue that hangs at the back of the mouth to prevent inflammation of the larynx. A small balloon is inflated around the trachea, holding it in place and allowing all the air in the trachea to reach the lungs. At this time, it is better to remove the laryngoscope. The nurse and team who performed the procedure will test to make sure the tube is in the right place (32).

The Dangers of Repentance

Repentance is a common and generally safe method that can help save lives. Most people recover within a few hours or days, but some rare side effects may occur:

Aspiration: When a person is intubated, they may inhale vomit, blood, or other fluids in their throat after regaining consciousness.

Intra-bronchial intubation: A tracheal tube can be placed in one of the two bronchi, a pair of tubes that connect the trachea to the lungs.

Esophageal intubation: If the tube enters the esophagus (food pipe) instead of the trachea, it can cause brain damage or even death if not diagnosed quickly.

Failure to secure the airway: When intubation is unsuccessful, health care providers may not be able to provide appropriate services to the individual

Infection: People with sinusitis may develop infections such as sinus infections.

Damage: This method can damage the mouth, teeth, tongue, vocal cords or respiratory tract. Injuries can cause bleeding or swelling.

Problems due to anesthesia: Most people recover well after anesthesia, but some of them have trouble waking up and need medical emergencies.

Tension pneumothorax: When the air gets trapped in the chest cavity, it can cause your lungs to collapse (33, 34).

Complications of Tracheal Intubation and Measures to Reduce Complications

Known complications when using a tracheal tube include complications during intubation, complications after intubation, and complications after extubation. Careful and continuous monitoring of the patient during and after intubation can slightly reduce these complications (35).

A- Complications during Endotracheal Intubation

1- Fear: Conscious patients might be afraid of intubation.

Actions: It is better to prepare the patient completely psychologically before the procedure if he is conscious. Explaining other methods of communication and making the news bell available for necessary cases, as well as assuring the patient that experienced personnel will be at his/her bedside whenever necessary, can effectively reduce the patient's anxiety (36, 37).

2- Trauma, laryngospasm and bronchospasm: Failure to fully observe the vocal cords during intubation, inserting the tube with pressure and violence may lead to the above complications.

Actions: Before intubation, the patient's throat and mouth should be completely cleaned of secretions, and the batteries of the laryngoscope should be completely strong and full of light.

3- Cardiac dysrhythmias: The most important dysrhythmia is bradycardia due to stimulation of the vagus nerve.

Actions: Prevention of complications such as low blood pressure.

4- Incorrect placement of the tracheal tube: There is always a possibility of wrong placement of the tracheal tube and its entry into the esophagus during intubation.

Actions: As soon as the tube is inserted, the cuff should be inflated, and then the patient should be given a few manual breaths through

the ambo bag, and while breathing, the tops of the patient's lungs should be checked for the presence of breathing sounds, and if there is no sound, the xiphoid area should be checked for entry. Air into the stomach should be auscultated. If the endotracheal tube is wrongly placed, correct its location immediately (37).

5- Excessive introduction of the tracheal tube: Excessive introduction of the tracheal tube into the patient's trachea, which may be directed into one of the bronchi (usually the right bronchus) causes problems; in such a situation, by filling the cuff of the tracheal tube, the other bronchus is closed and suffer from atelectasis due to lack of ventilation.

Actions: In order to control the replacement site of the end of the endotracheal tube, it is necessary to take a chest X-ray immediately after intubation. Also, bilateral auscultation of the lung sounds every two hours or after any change of position helps the patient (38).

6- Possible vomiting and aspiration: During oral intubation, if the gag reflex is stimulated, there is a possibility of vomiting and aspiration of the stomach contents into the trachea.

Actions: If there is sufficient time, it is better to place NGT before intubation and drain the gastric secretions.

7- Hypoxia due to delay in operation:

Actions: It is better to hyper-oxygenate the patient with 100% oxygen for one to two minutes before intubation. If it drops significantly and the disturbance in SaO₂ symptoms takes more than 30 seconds to intubate the patient or if hemodynamics occurs, the operation should be stopped and the patient should be ventilated with 100% oxygen by ambo bag and mask, and then intubation should be done again.

8- Upper airway trauma: One of the common traumas is injury to the patient's teeth, and bleeding and nasal septum fracture are complications of nasal pressure intubation.

Actions: In order to prevent this injury, care must be taken not to use the patient's upper teeth as a lever to pull up the laryngoscope blade during intubation (39, 40).

B- Complications of Intubation when the Tube Is in Place

1- Tracheal tube obstruction: Due to the accumulation of thick plaque secretions caused by dried secretions, bending and biting of the tube by the patient might happen and cause insufficient ventilation.

Actions: In order to prevent the bending of the tracheal tube, the patient's head should be placed in a natural position and the neck should be prevented from bending.

- The ventilator tubes should be supported by the pillow;
- Airway should be used to prevent gassing;
- over-inflating the cuff should be avoided to prevent herniation of the tracheal tube cuff on the end of the tube;
- Accurate and regular suction is necessary to prevent accumulation of the secretions and plaque formation inside the tracheal tube;
- Adequate humidity of the airways should be maintained;
- Any problems in passing the suction catheter in the tracheal tube should be reported;
- In case of failure to open the airway, you should replace the endotracheal tube in a timely and routine manner (37, 38).

2- Leakage from the cuff: The balloon not being filled after air injection, the patient's ability to speak after the cuff is filled???, and hearing air leakage in the larynx during breathing with positive pressure are symptoms of cuff leakage.

Actions: To avoid the risk of aspiration, the patient should be re-intubated.

3- Damage to the upper airways: Ulcers, necrosis, and narrowing of the trachea occur as a result of excessive pressure of the cuff on the tracheal wall, infection due to inappropriate size of the tracheal tube, and a long period of intubation.

Actions:

- To prevent pressure sores on the side of the lip, the position of the tube inside the mouth should be changed at least once every 24 hours, and a folded gauze should be placed between the tracheal tube and the corner of the lips.

➤ Diluted mouthwash is necessary to prevent the accumulation of oral pathogens in the airway (39, 41).

➤ To prevent abrasion injuries, head movements, especially forward and backward bending, should be done to a minimum.

➤ A suitable size tracheal tube should be used.

➤ To prevent glottis injuries, a tracheostomy tube should be placed after 10 days of intubation (41).

4- Injury to the trachea: Factors affecting the injury of the trachea include infection, duration of intubation, inappropriate size of the tracheal tube, incorrect positioning of the tracheal tube, cuff size, flexibility, shape and pressure inside the cuff, and finally hypotension.

Actions: In order to minimize the pressure of the cuff on the trachea, actions related to airway damage are helpful.

5- Bleeding: Hemorrhage from around the tube and its pulsation is the reason for damage or rupture of the innominate artery by the end of the tracheal tube.

Actions: Correct the position of the tube and use a narrower and shorter tube, and in case of bleeding, immediately inflate the cuff and inform the doctor. The final solution to this problem is surgery (Figure 3) (42).

6- Infection: Due to the elimination of upper airway defense mechanisms, the possibility of infection increases.

Actions:

➤ Airway suction should be performed with a completely sterile method and with a new catheter each time.

➤ The pipes and humidifier and vaporizer tank of the ventilator should be replaced every 24 hours, the water collected in the ventilator pipes should be drained, and care should be taken so that it does not enter the patient's airway (40).

C- Complications After Extubating the Patient

1- Larynx spasm or edema: It is one of the immediate side effects after extubating the patient, which potentially leads to airway obstruction.

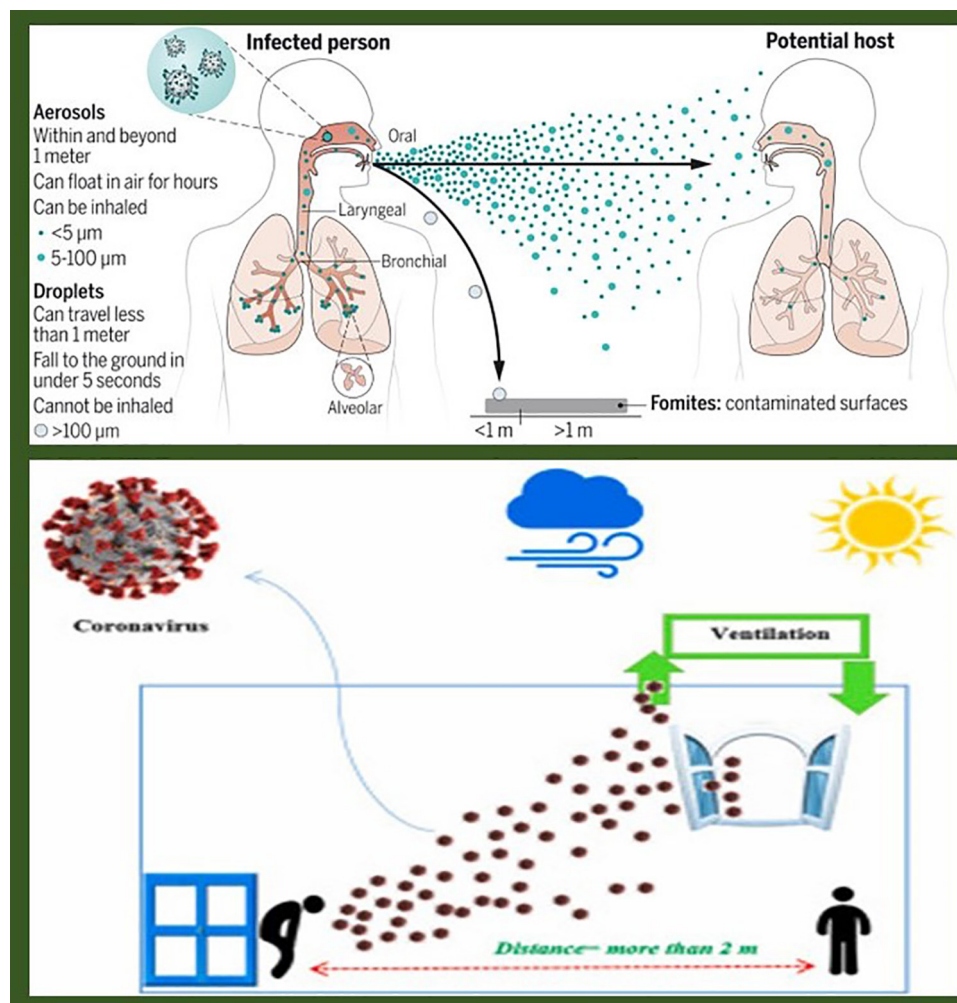


Figure 3: Airborne transmission of SARS-CoV-2 (40, 41)

Actions: The use of hydrocortisone can be effective in reducing laryngeal edema. Otherwise, re-intubation is necessary.

2- Stridor and voice violence: It is temporary and disappears within a week or two.

3- Formation of larynx and trachea granuloma: It causes airway narrowing or obstruction.

Actions: When the patient is intubated, regularly suction the secretions above the cuff so as not to cause chemical inflammation and tissue reaction around the contact area with the tracheal tube.

4- Widening of trachea and tracheomalacia: It happens after long-term intubation.

5- Stenosis of the larynx: Injuries at the level of the glottis and below the glottis are among the most serious intubation injuries.

Actions: This complication can be minimized by choosing the right endotracheal

tube, filling the cuff correctly, shortening the intubation time, preventing infection, and preventing the movement of the tracheal tube

6- Paresis or paralysis of the vocal cords: Damage to the laryngeal nerve may lead to paralysis of the vocal cords.

Actions: Such patients should be monitored for possible aspiration or upper airway obstruction and evaluated for swallowing reflex (Figure 4) (42, 43).

Online Teaching Methods for Intubation Training

The literature review identified several studies that investigated the effectiveness of online teaching for intubation in Covid-19 patients. These studies utilized various online platforms, including video-based modules, virtual simulations, and interactive webinars, to deliver training to healthcare professionals.



Figure 4: Reducing the risk of spread of Corona virus in intubation with the help of video laryngoscope (43)

The results consistently suggested that online teaching could effectively enhance knowledge acquisition and improve intubation skills among healthcare providers (44).

Knowledge Acquisition: The studies found that online teaching methods were successful in imparting theoretical knowledge related to intubation techniques. Participants who underwent online training demonstrated improved understanding of the anatomical landmarks, equipment usage, and procedural steps involved in intubation. Online modules with interactive elements, such as quizzes and case-based discussions, were particularly effective in reinforcing knowledge retention (45).

Skill Enhancement: Online teaching has also been proved to be beneficial in enhancing intubation skills. Participants reported increased confidence in performing intubation procedures after completing online training programs. The use of virtual simulations allowed for realistic practice scenarios, providing opportunities to refine technical skills, such as laryngoscope manipulation, tube insertion, and cuff inflation. Participants who engaged in simulation-based training demonstrated improved performance in simulated intubation scenarios (46).

Participant Satisfaction: Overall, healthcare professionals expressed high levels of satisfaction with online teaching programs. The flexibility and accessibility offered by online platforms were highly valued, allowing the participants to access training materials at their convenience and pace. Online training

programs also provided opportunities for self-directed learning and enabled the participants to review and revisit the content as needed. The ability to receive immediate feedback through online assessments and instructor-guided discussions further enhanced the participants' satisfaction (47).

Strategies for Enhancing Online Teaching to Address the Complexities of Intubation

Teaching intubation skills through online methods can be difficult due to the hands-on nature of the procedure. However, there are effective strategies that can be employed to enhance the online teaching experience and address the complexities of intubation. Consider the following approaches:

1. **Utilize multimedia resources:** Take advantage of high-quality videos, animations, and simulations to visually demonstrate intubation techniques. These resources provide a clear representation of the procedure and facilitate better understanding for students.

2. **Virtual reality (VR) training:** Explore the use of virtual reality technology to create realistic intubation scenarios. VR offers an immersive learning experience, enabling students to practice intubation techniques in a controlled virtual environment (48).

3. **Live demonstrations:** Conduct live demonstrations of intubation procedures using video conferencing tools. This allows students to observe the technique in real-time and interact by asking questions as the

procedure unfolds.

4. **Case-based learning:** Present the students with realistic case scenarios where intubation may be necessary. Discuss the indications, contraindications, and decision-making process involved in selecting the appropriate intubation technique for each case. Encourage active participation and the sharing of thoughts among the students (46).

5. **Interactive discussions:** Facilitate online discussions and forums where students can ask questions, share experiences, and engage in peer-to-peer learning. Encourage students to discuss challenges they may encounter during intubation and brainstorm strategies to overcome them.

6. **Online simulation platforms:** Explore dedicated online simulation platforms that allow the students to virtually practice intubation. These platforms often provide interactive modules and feedback mechanisms to help the students improve their technique.

7. **Provide self-paced learning resources:** Develop self-paced modules or e-learning courses that cover the theoretical aspects of intubation. Include interactive quizzes, case studies, and knowledge checks to reinforce learning and assess comprehension (46, 45).

8. **Expert guest lectures:** Invite experienced practitioners or experts in the field to deliver guest lectures on specific aspects of intubation. This provides students with insights from professionals who possess extensive hands-on experience and can share practical tips and tricks.

9. **Collaborative projects:** Assign students to work on collaborative projects related to intubation. This could involve researching and presenting specific intubation techniques, discussing case studies, or creating educational resources. Collaboration promotes active learning and helps students develop critical thinking skills.

10. **Feedback and assessment:** Provide timely and constructive feedback on students' performance in virtual intubation simulations or assessments. This feedback helps students understand their strengths and areas for improvement, enabling them to refine their

skills (48, 49) (Table 1).

Discussion

In this literature review, we explored the complexities of intubation in Covid-19 patients and its implications for online teaching.

Identify and Understand the Complexities Associated with Intubation in Covid-19 Patients

Intubation in Covid-19 patients is a complex procedure that can lead to various complications. Studies showed that Covid-19 patients who had undergone endotracheal intubation and tracheostomy during their hospitalization had a high incidence of post-extubating stridor and laryngeal injury (50). Another study compared intubation and airway complications between Covid-19 and non-Covid-19 critically ill subjects and found that Covid-19 subjects were more likely to be intubated for acute respiratory distress (51). Tracheal stenosis is also a complication associated with prolonged intubation in Covid-19 patients (52). Health care personnel who perform endotracheal intubations on Covid-19 patients are at high risk of exposure to and transmission of SARS-CoV-2 (53). Therefore, it is important to identify and understand the complexities associated with intubation in Covid-19 patients to minimize the risk of complications and protect the health care personnel performing the procedure.

Assess the Effectiveness and Adequacy of Existing Online Teaching

Online teaching has become increasingly popular in recent years, and especially during the Covid-19 pandemic. There are several studies that assess the effectiveness and adequacy of the existing online teaching. According to a report by the U.S. Department of Education, online learning can produce learning outcomes equivalent to or better than face-to-face learning (54). Additionally, online courses have increased student retention rates about 25–60% (55). However, the sudden transition to online

Table 1: Summary of the articles

Author, year	Title	Type of study	Research community	Results
Mohammadi et al, 2021 (28)	Invasive Airway "Intubation" in COVID-19 Patients; Statistics, Causes, and Recommendations	Review	COVID-19 Patients	Acute respiratory distress in COVID-19 patients could require endotracheal intubation and mechanical ventilation. Severe respiratory distress, loss of consciousness, and hypoxia had been the most important reasons for intubation. Also, increased levels of C-reactive protein (CRP), ferritin, d-dimer, and lipase in combination with hypoxia are correlated with intubation. Old age, diabetes mellitus, respiratory rate, increased level of CRP, bicarbonate level, and oxygen saturation are the most valuable predictors of the need for mechanical ventilation.
Wali et al, 2020, (31)	Pneumomediastinum following intubation in COVID-19 patients	a case series	Five patients	Although rare, development of pneumomediastinum in COVID-19 patients may be a negative prognostic marker. The combination of alveolar damage and weakness of the membranous wall of the trachea, intubation potentially in emergent scenarios, frequent proning and barotrauma from high ventilator pressures may predispose this patient cohort to severe pneumomediastinum.
Nauka et al, 2020, (38)	Practice, Outcomes, and Complications of Emergent Endotracheal Intubation by Critical Care Practitioners During the COVID-19 Pandemic	Retropective study	Patients with COVID-19	Video laryngoscopy and <u>neuromuscular blockade</u> were used increasingly during the COVID-19 pandemic. Despite a higher rate of first-pass success during the pandemic, the incidence of complications associated with the procedure was higher.
Carroll et al, 2010, (39)	Emergent endotracheal intubations in children: Be careful if it's late when you intubate*	Retropective cohort study.	137 children	Emergent endotracheal intubations are commonly performed in children, are two times more likely to occur off-hours, and are associated with three times the risk of complications as nonemergent intubations.
Dancy, 2021, (41)	Efficacy of Apneic Oxygenation During Pediatric Endotracheal Intubation Difficult tracheal extubation due to endotracheal tube malfunction: A challenge during the COVID-19 pandemic	Literature review	712 patients	The findings in this study confirm that the practice of AO is not only efficacious in increasing the time until initial desaturation but also reduces the overall incidence of hypoxia during laryngoscopy in children.

Bamgbade, Olumuyiwa, 2021, (42)	Difficult tracheal extubation due to endotracheal tube malfunction: A challenge during the COVID-19 pandemic	Case Report	Two cases of difficult extubation	This case series highlights the risk of COVID-19 virus transmission during difficult extubation. This report describes the preventive and reactive management of difficult extubation.
Gandhi et al, 2020, (46)	Emergency Tracheal Intubation in Patients with COVID-19: Experience from a UK Centre	Official guidance from UK national societies	COVID-19 patients	Findings demonstrate that a consultant-led mobile intubation team can safely perform tracheal intubation in critically ill COVID-19 patients across all clinical areas, aided by thorough preparation and training, despite heightened anxiety levels.
Ferri et al, 2020, (50)	Online Learning and Emergency Remote Teaching: Opportunities and Challenges in Emergency Situations	Qualitative research method	Researchers, professors and enterprises	Based on the lessons learned from this worldwide emergency, challenges and proposals for action to face these same challenges, which should be and sometimes have been implemented, are provided.

learning has posed many challenges to faculty and students, and faculty may not have had adequate time to carefully design online courses to take full advantage of the possibilities of the online format. Therefore, the effectiveness of online teaching depends on the design of the learning environment and the strategies used to support learning. Faculty members need to put in more effort to ensure having interactive online courses (56). In conclusion, while online teaching has its advantages, it requires intentional focus and careful design to be effective and adequate.

Online Intubation Training

Online intubation training has become increasingly popular in recent years, especially due to the Covid-19 pandemic. One study compared the intubation success rate and other skills between junior and senior medical professionals using a high-fidelity simulator. The study found that seniority did not always correlate with simulated intubation performance, indicating that training and experience are crucial factors in successful intubation (57).

While online intubation training courses are available, it is important to note that providers should optimize positioning, pre-oxygenation, equipment, and team preparation

when preparing for endotracheal intubation. In addition, providers should be ready to perform other methods of intubation if the initial attempt is unsuccessful. Simulation-based learning, including simulated discussions and communication with standardized patients, has been found to be effective in higher education. In a simulation study comparing direct laryngoscopy and video laryngoscopy, it was found that experience was a significant predictor of successful intubation (58). In a systematic review and meta-analysis, it was found that experience in pre-hospital endotracheal intubation significantly influenced mortality of patients with severe traumatic brain injury. Studies were classified as “limited experience” if intubation was performed by the personnel who usually have basic skills in this technique and who commonly only infrequently perform intubations in routine practice, while “extended experience” was selected if intubation was performed by pre-hospital emergency physicians or nurses/paramedics with an extended scope of practice and training. Overall, while online intubation training can be a useful tool, it is important to note that training and experience are crucial factors in successful intubation. Providers should also be prepared to perform

other methods of intubation if the initial attempt is unsuccessful (59).

One of the limitations of this study is the potential for publication bias. The literature review conducted for this study only included articles published between January 2018 and September 2022. When limiting the search to this specific time frame, there is a possibility that relevant studies published before or after this period were excluded. This could lead to a biased representation of the available evidence and may overlook important findings or advancements in the field of intubation complications and online teaching strategies. Additionally, the search was limited to specific electronic databases, namely PubMed, Embase, and Scopus, which may not include all relevant studies. The exclusion of studies from other databases or gray literature sources could limit the comprehensiveness of the findings and potentially introduce a bias in the selection of studies.

Conclusion

The bedside screening tests reviewed in this review are not well suited to detect unanticipated difficult airways because they miss a large number of individuals with difficult airways. In this research, it shows the effectiveness of sharing a ventilator between patients with the disease of Covid-19 with the appropriate selection of patients, which can be helpful to the treatment staff and patients in the situation of lack of facilities. The review highlights the potential benefits of online learning for healthcare professionals involved in intubation of Covid-19 patients. When grouping patients for ventilator sharing, it is necessary to compare respiratory parameters between two patients and, if possible, put two patients in the same group. Among patients with severe Covid-19, the use of high-flow oxygen via nasal cannula significantly reduced the need for mechanical ventilator support and the time to clinical recovery compared with conventional low-flow oxygen therapy. In general, in cases where surgery is performed under general anesthesia, gastric

intubation will be necessary. This means that most surgeries require this type of care. Although the constant need for a ventilator is scary, most surgical patients can breathe on their own within a few minutes after the end of the surgery.

Despite the positive outcomes, there are certain limitations associated with online teaching for intubation in Covid-19 patients. The lack of physical hands-on practice and direct supervision inherent in online training may hinder the transfer of skills to real-life scenarios. The absence of tactile feedback and the inability to navigate potential complications in real-time can pose challenges during actual intubation procedures. Therefore, it is essential to supplement online teaching with practical hands-on sessions to bridge this gap.

Authors' Contribution

All authors (KG and KA) have reviewed and revised the manuscript all authors agree on the final version.

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Relationship between Kolb's Learning Styles and Readiness for E-learning: A Cross-sectional Study in the Covid-19 Pandemic

Sareh Mehni¹, PhD Candidate;  Farshid Chahartangi¹, PhD Candidate; Mahsa Tahergorabi², PhD; Neda Dastyar^{3*}, MSc;  Akbar Mehralizadeh⁴, PhD; Azimeh Amirmijani⁵, MSc

¹Student Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran

²Department of Environmental Health Engineering, Jiroft University of Medical Sciences, Jiroft, Iran

³Department of Midwifery, Nursing and Midwifery School, Jiroft University of Medical Sciences, Jiroft, Iran

⁴Department of Statistics, School of Medicine, Jiroft University of Medical Sciences, Jiroft, Iran

⁵Jiroft University of Medical Sciences, Jiroft, Iran

ABSTRACT

Background: Significant changes have occurred in education, including the emergence of E-learning which appeared to be an alternative method of carrying out teaching and learning activities. This research seeks to examine the correlation between Kolb's learning styles and readiness for e-learning.

Methods: This cross-sectional study was conducted in Jiroft University of Medical Sciences (southern Iran) in 2021. 247 eligible medical students were selected using convenient sampling. Data were collected using the Watkins standard e-learning questionnaire and Kolb's learning styles questionnaire. Data were analyzed by SPSS version 23 using descriptive and inferential statistics (ANOVA and post hoc LSD tests) which were all used to find connections. A P-value<0.05 was considered statistically significant.

Results: The participants' mean age was 21.5 (SD: 1.69) years and average score in the e-learning readiness tests was 127.54 (SD: 27.05). According the findings of this study, the learning style of most students was divergent (104 (42.1%)). One-way analysis of variance, showed that there was a statistically significant difference between the average e-learning readiness ratings for various learning styles (F=3.20, P=0.024). Converging style is the top favored learning style among students who are ready for online learning, according to researchers.

Conclusion: According to the findings of the study, students' learning styles were statistically relevant to their readiness for e-learning. The study may be useful for a balanced pedagogical system in both pandemic and post-pandemic situations. University planners need to pay special attention to the students' learning styles because one of the ways to increase preparation for e-learning is to know the students' learning style.

Keywords: Learning, Education, Students, Medical, Distance, Covid-19, Readiness

*Corresponding author:

Neda Dastyar, MSc;
Department of Midwifery,
Nursing and Midwifery
School, Jiroft University of
Medical Sciences, P.O. Box:
78617-63730, Jiroft, Iran
Tel: +98 9193418943
Email: nedadastyar98@gmail.
com

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Introduction

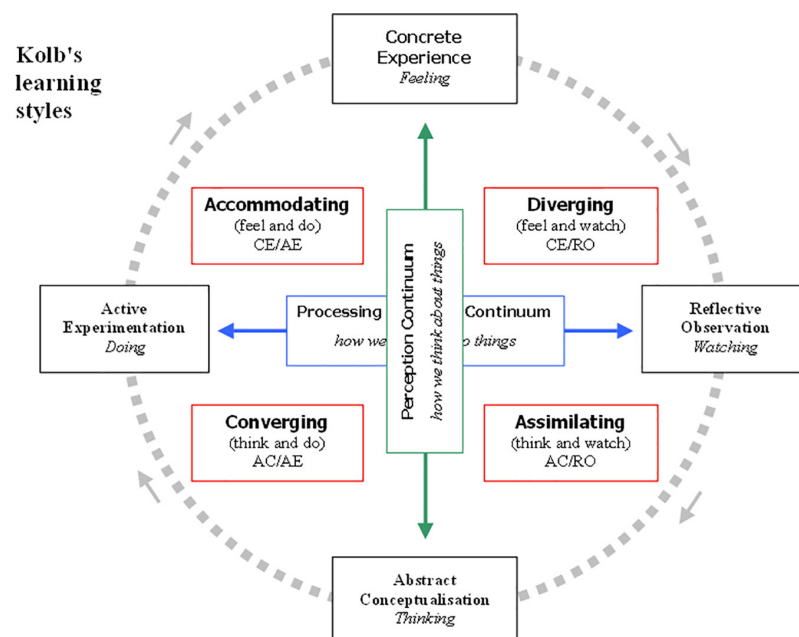
Before the school shutdown due to COVID-19, significant changes had occurred in education, including the emergence of E-learning (1). During this crisis, e-learning appeared to be an alternate method of carrying out teaching and learning activities (2). E-learning is the act of learning using electronic tools and procedures (3). Web-based learning, computer-based learning, virtual classrooms, and online collaboration are all examples of e-learning methods and applications. The Internet, intranet, extranet, satellite TV, and CD-ROM with multimedia capabilities are all used to provide content (4).

Adaptive and personalized e-learning systems, which meet the learners' variety and unique requirements, are essential nowadays in order to get the most out of these systems (5). The majority of the current studies employ learner/user modelling to accomplish adaptive personalization (6). The combination of personality traits, behavioural factors, and knowledge factors is known as the learner model (7, 8). Additionally, as a result of personality traits, learners have a variety of styles or methods to learn (9). According to Felder and Silverman (1988), students learn more efficiently and make better progress

when they have learning material that suits their learning styles (10).

Learner modelling based on learning styles has gained a great deal of attention in the literature as a result of these findings (11, 12). Learner attributes and needs play a crucial role in the educational domain. As a result, learning styles are given a lot of attention in the literature for a long time (13). A person's innate preferred methods of acquiring, processing, and remembering new knowledge, and remembering new knowledge and abilities are referred to as their learning style (14).

Kolb's learning style model and the experiential learning theory are based on the research of Dewey who views the experience as the foundation of learning, Lewin who emphasizes the value of individuals' active participation in the learning process, and Piaget who views intelligence as more than just an innate quality, but also as the result of interactions between people and their surroundings. The comprehension and transformation aspects that Kolb shows about learning styles are represented by the four-step cycle represented in Figure 1 as Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and



© concept david kolb, adaptation and design alan chapman 2005-06, based on Kolb's learning styles, 1984
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Figure 1: Kolb's learning styles (17)

Active Experimentation (AE) (15).

In general, concrete experience calls for complete individual engagement in an activity, reflective observation calls for the development of various viewpoints, abstract conceptualization calls for the acquisition of theoretical information, and AE calls for the application of knowledge. Learners may be classified as Diverger, Assimilator, Converger, or Accommodator based on a visual profile that is displayed on the Learning-Style Type Grid. The mix of Concrete Experience (CE) and Reflective Observation (RO) creates the diverging learning style (16).

Divergers may see certain events from different angles and, in any case, prefer to watch rather than take immediate action. Students with this learning style are characterized as imaginative and emotive, and they like generating ideas by the use of their imagination, perception, identification of problems, analysis from many angles, and adaptation (18).

Weak points are expressed as difficulties in making judgments, selecting among options, and even failing to evaluate learning possibilities. Both Active Experimentation (AE) and Reflective Observation (RO) fall under the assimilating learning style. The assimilators are very good at combining large amounts of information into a logical whole (16).

It has been shown that students who learn by assimilation are able to plan and recognize issues, but frequently struggle to implement a systematic strategy in practical settings. They are told that they need to get better at gathering data, building conceptual models, testing ideas and hypotheses, and taking probabilities into account rather than just current circumstances. Assimilating learners typically concentrate on abstract concepts and ideas, learn by listening and observing, and consider their teachers as the most reliable sources of information (18).

Combining Abstract Conceptualization (AC) and Active Experimentation (AE) results in converging learning style. They are the idea practitioners. It is highlighted

that these people are capable of advanced logical analysis and deductive reasoning, have suitable decision-making and problem-solving abilities, and prefer dealing with technical difficulties over social and interpersonal interactions. Combining AE and Concrete Experience (CE) results in accommodating learning style. The accommodators can use their previous experiences to their advantage. These students possess leadership qualities, favor interpersonal interactions, and seek out other people's personal knowledge above technical answers. They are regarded as inquisitive and investigative, and they are notable for their initiative, adaptability, and open-mindedness (16).

Overcoming the obstacles of e-learning is crucial for its successful adoption, particularly in developing and disaster-stricken nations like Iran. The preparation for e-learning is a timely strategy to recover from the problem brought on by pandemic illnesses (such as COVID-19) in the education industry. Yet, it is essential to look at the aspects that are connected to e-learning, including learning styles, in order to make e-learning more viable as a qualified substitute for conventional face-to-face learning. Nevertheless, to the best of our knowledge, no research has been done on the relationship between learning styles and e-learning preparedness in Iran during the COVID-19 pandemic.

Methods

Study Design

This cross-sectional descriptive study was conducted from the beginning of October to the end of November 2021 on 247 medical students of Jiroft University of Medical Sciences.

Research Environment, Sampling and Participants

The study population included all medical students of Jiroft University of Medical Sciences who met the inclusion criteria. They were selected using convenience sampling based on the inclusion criteria.

The criteria for entering the study

included having a history of studying at Jiroft University of Medical Sciences for at least 2 years and being willing to participate in the study.

The exclusion criteria were unwillingness to continue participating in the study and failure to complete all questionnaire items.

In order to determine the sample size, we used the correlation sample size formula ($N = [(Z_{\alpha} + Z_{\beta})/C]^2 / r^2$). Based on the correlation sample size formula ($Z_{\alpha} = 1.96$, $Z_{\beta} = 1.03$, $\alpha = 0.05$, $\beta = 0.15$, and $r = 0.20$) with 10% increase, 270 questionnaires were distributed, but only 247 of them filled out the questionnaire. The response rate was 92%.

Data Collection Tools

The data collection tool included three questionnaires:

1- Demographic information, which collected information on age, gender and marital status.

2- Kolb's learning styles inventory - version III (KLSI-III): There are 12 items and 4 sections on the scale. The four options in each item are scored between 1 and 4. The lowest score on the scale is 12, and the highest score is 48. After scoring, unified scores are calculated, which are obtained in the form of Abstract Conceptualization (AC), Concrete Experience (SC) and Active Experimentation (AE), and Reflective Observation (RO); the scores obtained as a result of this process range from -36 to +36. Positive score obtained by AC-SC indicates that the learning is abstract, whereas the negative score is concrete; similarly scores obtained by AE-RO indicate that the learning is active or reflective. Unified scores are plotted on the coordinate system. The score obtained by AE-RO is plotted on the horizontal axis, and that obtained by AC-SC is plotted on the vertical axis and the intersection of these two scores represents the individual's learning style (19, 20). The validity and dependability of the translated version of this questionnaire have been demonstrated by Hejazi et al. (21) in Iran. The questionnaire is scored in accordance with its instructions and the total

scores received for each of its sections; then, the dominant learning style of each individual is identified as a nominal variable. In the present study, the reliability of this tool was checked by calculating Cronbach's alpha as 0.82. Also, to determine the content validity of this questionnaire, the researchers checked the Content Validity Ratio (CVR) and the Content Validity Index (CVI). It was found that CVI=0.91 and CVR=0.74.

3- The Watkins et al.'s (22) standard e-learning questionnaire: This 27-item questionnaire includes questions about the students' readiness to participate in e-learning, which are categorized into six factors (access to technology, motivation, ability to learn through the media, Internet group discussions, and important issues for success in e-learning). Also, a 5-point Likert scale was used for scoring, i.e. the students were asked to choose one of the options according to their readiness: strongly disagree (score=1), disagree (score=2), have no opinion (score=3), agree (score=4), and completely agree (score=5). The minimum possible score was 27, and the maximum score was 135. Also, a score between 27 and 45 was considered as low level of e-learning; a score between 45 and 90 was considered as moderate level of e-learning, and if the score was above 90, the level of e-learning was considered high. The reliability of the questionnaire in the study of Ahangar Seleh Bani (2014) was obtained 84% with Cronbach's alpha for the whole questionnaire, which indicates that the test has acceptable reliability (23). In the present study, the reliability of this tool was checked by calculating Cronbach's alpha as 0.75. Also, to determine the content validity of this questionnaire, the researchers checked the Content Validity Ratio (CVR) and the Content Validity Index (CVI). It was found that CVI=0.84 and CVR=0.69.

Data Collection

After obtaining permission from the ethics committee of Jiroft University of Medical Sciences and obtaining permission from the authorities, the researcher referred to the

education department of the medical school and prepared a list of eligible students and their contact information. The main researcher contacted the medical students by telephone, invited them to enroll in the program, and fully explained the objectives, research methodology, and voluntary participation to the students. Then, we obtained their verbal informed consent. The address of a questionnaire link, which was created and prepared using the Porsline service, was sent to students via the WhatsApp platform by the main researcher in order to conduct the study. The link included personal information, the Kolb Learning Style Inventory (KLSI), and the Standard e-learning questionnaire of Watkins et al. The questionnaire link was personally completed. The approximate time to complete the questionnaire link was 25 minutes.

Data Analysis

The data obtained from the questionnaires were entered into the computer after coding. Then, it was analysed through SPSS version 23 using descriptive and analytical statistics. The students' overall SDL preparedness and its subscales were determined using mean scores. Items that fit into a particular style were grouped for LS, and cumulative mean scores were computed. ANOVA and post hoc LSD

Table 1: Gender, e-readiness, and learning style of the students

Variable	Number (%)
Gender:	
Male	78 (31.6)
Female	169 (68.4)
Learning style:	
Diverger	104 (42.1)
Accommodator	84 (34)
Converger	35 (14.2)
Assimilator	24 (9.7)
E-readiness:	
Low	19 (7.7)
Moderate	190 (76.9)
High	38 (15.4)
Total	247 (100)

tests were all used to find the connections.

Results

Among the 247 participants, 78 (31.6%) were male and 169 (68.4%) were female. The mean age was 21.5 years±1.69 months (range: 17-28 years). The average score on the e-learning readiness tests was 127.54. (SD: 27.05). Gender, e-readiness, and learning style of the students are shown in Table 1.

According to the findings of a one-way analysis of variance, there was a statistically significant difference between learning styles in terms of the average e-learning readiness values (F=3.20, P=0.024) (Table 2).

Table 2: Comparison of learning styles in terms of e-readiness rate

Learning style	Mean(SD)	F	P value
Diverger	86.60 (24.7)	3.20	0.024*
Converger	80.42 (23.1)		
Accommodator	78.32 (17.3)		
Assimilator	75.04 (20.5)		
Total	81.78 (22.12)		

*ANOVA

Table 3: Two-by-two comparison of learning styles in terms of e-readiness rate

Learning style(i)	Learning style(j)	Mean Difference(i-j)	Std.Error	P value
Accommodator	Converger	-2.10	4.39	0.632**
	Assimilator	3.27	5.05	0.517**
	Diverger	-8.28	3.20	0.01**
Converger	Assimilator	5.38	5.78	0.353**
	Diverger	-6.17	4.26	0.149**
Assimilator	Diverger	-11.56	4.94	0.02**

**Post hoc LSD

The findings of the post hoc LSD test revealed that the divergent learning style had considerably lower average scores than the absorbing and adaptive learning styles in terms of e-learning preparedness. (Table 3)

Discussion

According to the findings, there was a strong correlation between learning styles and e-readiness. The majority of Jiroft University of Medical Sciences students (42.1%) had divergent learning style, while just 9.7% of them had assimilator learning style.

Similar to the current study, Bayrak (2017) (24) and Yavuzalp et al. (2017) (25) stated the dominant style of Turkish students was the divergent style, while El-Gilany et al. (2013) (26) found that the least style among Saudi students was divergent. In other studies such as those of Ata et al. (2019) (20), Tuncer et al. (2018) (27), and Senyuva (2017) (28) in Turkey, and Manouchehr (2006) (29) in Qatar, it was found that the most common learning style is assimilator style. This goes against the results of the current study. The varying learning styles of students in different studies appear normal since learning styles can vary for a variety of reasons. Such causes include personality traits, learning settings, subjects, and teaching techniques.

The capacity to observe carefully and the desire to interact with others are the biggest strengths of the pupils with divergent learning style. Researchers found a substantial difference in students' learning styles and readiness for online learning based on comparisons and analysis they did within these two categories. The differences in learning styles between normal and online learners were studied by Nick Zacharis in 2011 (30). Results showed that there was no impact on chosen modes of learning, such as online and traditional, and the capacity to successfully finish courses. Converging style is the top favoured learning style among students who were ready for online learning, according to researchers. Diverging and accommodating learning styles came next.

According to Kolb (2009) (19), students

who utilize abstract conceptualization prioritize scientific methods for problem-solving above creative approaches, which are representative of the concrete experience dimension. Therefore, choosing an abstract way of thinking is a step toward giving meaning to the content that is important to converging learning styles. Converging style is best at making ideas and theories work in the real world.

E-learning prefers to solve difficulties and discover solutions for issues, problems, and make decisions about them in the decision-making phase. They favour working on technical problems over interpersonal and social ones. Some preferred and appropriate methods of learning among asynchronous e-learners include doing individual assignments, online laboratories, and listserv. This latter would serve to distribute various types of information including text, video, graphic, and sound, experimenting with new ideas, simulations, labs, and practical applications, and doing individual assignments. The two primary learning capacities for a person who prefers the assimilation approach are Abstract Conceptualization and Reflective Observation (RO).

Limitations and Suggestions

There are two significant limitations to the present research. First, these results need to be considered from the perspective of Jiroft medical students because medical education can differ widely around the globe depending on a number of different factors. Also, its generalizability is restricted because it was conducted at a single medical college. It is advised to do interventions, qualitative investigations, and longitudinal studies, as well as research in settings with diverse cultures and a larger statistical population.

Conclusion

According to the study findings, the students' learning styles were statistically relevant to their readiness for e-learning. The study may contribute to a balanced pedagogical system in both pandemic and

post-pandemic situations. University planners need to pay special attention to the students' learning styles because one of the ways to increase preparation for e-learning is to know the learners' learning style.

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Author Contribution

All authors (S M, M TG, N D, A MAZ, A AMJ, and F CH) conceptualized the study, and all were major contributors to writing the manuscript. All authors approved the final manuscript.

Conflict of Interest: None declared.

Ethical Considerations and Participants Consent

The Jiroft University of Medical Sciences Ethics Committee approved this study (IR. JMU.RCE.1399.05). Students were reassured that their participation was voluntary and that their information would remain confidential. Due to the Covid-19 pandemic and the nature of the study, obtaining verbal informed consent was approved by the ethics committee of Jiroft University of Medical Sciences.

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The Effect of Two Online Versions of Etymological and Non-etymological-based Games on Vocabulary Learning and Retention of Iranian Language Learners: An Educational Intervention

Golnaz Arabsaeedi¹, MA;  Fatemeh Hemmati^{1*}, PhD;  Fatemeh Takallou¹, PhD

¹Department of TEFL and English Literature, Payame Noor University, (PNU), Tehran, Iran

ABSTRACT

Background: Vocabulary learning is of paramount importance in language learning. Thus, effective ways of teaching new words are sought after by language teachers. This study aimed to investigate the effectiveness of three techniques of vocabulary teaching on learning and retention.

Methods: Initially, 80 upper intermediate female learners of Iran Oxford institute in Tehran participated in this one sample time series quasi-experimental study. Based on the Oxford Online English -Vocabulary Level Test, 37 learners were qualified. In Summer 2021, they took part in the first phase and received the routine treatment. The same students took part in the first experimental group and received the non-etymological-based online game, although only 33 students turned up. In the last stage, the number of participants reduced to 30; therefore, the data analyses were done with 30 students. After each stage, a posttest and a delayed posttest (taken from Building English Vocabulary with Etymology from Latin) were administered. One way ANOVA and Scheffe's Test were run to compare the groups.

Results: The results indicated that the etymological game group outperformed ($M=13.16$, $SD=1.17$) the non-etymological ($M=12.00$, $SD=2.33$, $P=0.04$) and control groups ($M=11.10$, $SD=1.53$, $P<0.001$). Moreover, the difference between the non-etymological group and the control group was significant ($P=0.048$). In the delayed posttest, a significant difference was detected between the etymological game group and the control group ($P<0.001$). Besides, the etymological game group gained a significantly higher mean score mean score ($M=12.40$, $SD=1.83$) than the non-etymological game group ($M=9.93$, $SD=1.99$) ($P<0.001$). However, the non-etymological game group did not significantly outperform the control group ($P=0.915$).

Conclusion: The results of post- and delayed post-tests indicated that the etymological game group had the best result followed by non-etymological game group.

Keywords: Learning, Education, Distance, Research, Game, Kahoot, Vocabulary, Etymological and non-etymological

*Corresponding author:

Fatemeh Hemmati, PhD;
Department of TEFL and
English Literature, Payame
Noor University, (PNU), P.O.
Box: 19395-4697, Tehran, Iran
Email: Hemmati@pnu.ac.ir

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Introduction

Vocabulary is, indisputably, a fundamental component of learning a language as knowing fewer words in a language adversely impacts different language skills. Vocabulary knowledge is needed for interact with others (1) and language learners lose interest and are driven to frustration when facing communication circumstances demanding vocabulary knowledge beyond their ability (2). Research has showed that depth and breadth of vocabulary knowledge play a vital role in English language learners' reading comprehension performance (3), listening comprehension (4), and is a predictor of their performance in speaking and writing (5). Also, the use of vocabulary learning strategies to develop vocabulary knowledge and to facilitate the retention of second language (L2) vocabulary has been the subject of a number of L2 studies (6). The use of word etymology and the derivation or origins of words as a vocabulary learning strategy makes English as a foreign language (EFL) learner cognizant of the etymological structure of words and thus enables them to decode unseen and unheard words through breaking them into basic elements (e.g., affixes and roots) (7). Such etymological knowledge also empowers EFL learners to construct thousands of English words accurately (8). Not only does the knowledge of etymology help learners strengthen their current vocabulary knowledge but also it helps them conceive undefined English words in the future (9).

One rational explication for the benefits of etymology can be found in Dual Coding theory (10). As Boers, Eyckmans, and Stengers (11) stated: "the etymological information is likely to call up a mental image of a concrete scene which can then be stored in memory alongside the verbal form, and which can subsequently provide an extra pathway for recall". Although morphological studies (10-12) have been carried out in the context of Iranian EFL learners to show the significance of teaching and learning through etymology, there have been a limited number of English

language schools and institutes to employ etymological-based books, syllabus, or approaches in concept of vocabulary learning and teaching. Furthermore, nowadays, in the technologically advanced societies, traditional vocabulary enquiries are tedious, especially for EFL learners who are brought up in the digital era (13).

With the development of the 4th Industrial Revolution in education, Cybergogy (14) motivated teaching and learning exercises in the virtual environment. One of the considerable accomplishments of the beginning of the twenty-first century is Gamification which has traversed various domains such as culture, technology, society, economics, and healthcare (15). Gamification, the self-determined nature of activities such as similar characteristics of games (16-18), has made its way to the realm of vocabulary learning. Over the past years, vocabulary learning has transformed from monotonous traditional learning resulting in motivation loss and boredom into technological learning (19). Besides, independent learning as the other feature of Gamification has proved to play an important role in tackling the lack of time in some English classes (20, 21). Therefore, in this study, the effect of the combination of online game and etymology-based vocabulary learning are studied.

A significant body of research has investigated vocabulary instruction. Research has shown that both learners and educators perceive vocabulary instruction as fruitful and admit the effectiveness of vocabulary instruction (22, 23). Direct vocabulary teaching has been reported to be more efficient and more effective than independent reading or incidental learning (24).

Taking advantage of morphological knowledge, a basic strategy to concentrate on the structure of a word, i.e., roots and affixes, is one of the approaches to teaching words (25). Accordingly, constructive vocabulary instruction should entail direct instruction in affixes (prefixes and suffixes) and roots. The activity of morphological strategy shows that an acceptable understanding of morphology

along with the capability of using contextual and definitional clues presents a powerful and practical combination that can help learners to figure out the precise definition of new words (25).

Learners learn through relation between new information and prior learning knowledge which is a constructive kind of learning (26). Therefore, based on the Meaningful Theory of Ausubel (27), consisting of the relationship between related prior knowledge and non-arbitrary couple with non-literal interaction of novel knowledge, and etymological instruction can be beneficial in language learning and can be practical for learners to explicate the spelling of a word and retain the meaning of a word from its morphological origins (28).

Besides, as Frances and Simpson (29) pointed out, vocabulary teaching should be geared to learners' beliefs or interests. Nevertheless, learners deem vocabulary learning to be tedious (30) and express their preference for online learning as opposed to traditional learning (30, 31). Therefore, teaching strategies congruent with learners' interest, which can be the combination of technology and vocabulary teaching, should be employed (32).

Moreover, gamification, the conversion of the learning procedure into game (33), is yet another approach inspiring learners to learn new words. Deterding (17) coined gamification to the usage of game elements in different non-game contexts. A game is defined as a system in which an abstract and conceptual challenge is provided for players to engage (34). The challenge can be elucidated by rules, feedback, and interactivity, which culminates in an assessable result often eliciting a sentimental and emotional reaction. As Whitton (35) pointed out, fundamental elements of games in education are challenging activities, doing meaningful and problematic tasks which are constructed with rules, objectives, rewards, and progression. Furthermore, games entail a social aspect and are typically played with other people.

Games provide an enjoyable platform for learners in learning concept among which gamification and game-based learning approaches can be utilized to improve the learning process of learners by motivating and engaging them as digital natives (36). In the realm of education, the gamification approach is utilized to engage and motivate learners by fun environments, fostering intense focus, fun, collaboration, and competitiveness. Games provide multitude advantages to the learning and teaching process, yet some problems can be brought when they are not utilized appropriately. Several of the benefits can be noted: creating continuous motivation for learners to accomplish the learning tasks, creating enjoyable and engaging educational environment, fostering learners' attentiveness and lastly, fostering healthy and enjoyable competition between peers (36). However, it is worth mentioning that creating a really engaging, perfect instructional game is time consuming, pricey, and difficult (34). Furthermore, research into gamification in vocabulary has yielded inconclusive results as some studies have shown a constructive effect on learners' motivation and learning outcomes (21, 37) while some other did not. In addition, although root-based learning is one of the ways which has revealed beneficial results in vocabulary learning, there are some researches which point out the opposite (38). Thus, this study was conducted to investigate the effects of combination of gamification and etymology in vocabulary learning and retention of Iranian EFL learners. Taking the characteristics of gamified vocabulary learning such as independent learning, collaboration, and problem-solving (34), the present research targeted to shed light on the effect of two online versions of etymological and non-etymological-based games on vocabulary learning and retention of Iranian EFL learners. The research focused on the etymology of English vocabularies with an online research-tailored game and aimed to find out: 1) whether there was any significant difference in students' vocabulary learning in non-gamified instruction versus two versions

(Etymological and Non-etymological) of an online game in the posttest, and 2) whether there were any significant difference in students' vocabulary retention in non-gamified instruction versus two versions (Etymological and Non-etymological) of an online game in a delayed posttest.

Methods

Study Design

This one sample time series quasi-experimental study with a pretest, posttest and delayed posttest design was carried out through comparing analysis of non-etymological-based and etymological game groups and non-game group as two experimental groups and control group, respectively. The independent variables were etymological and non-etymological online games and the dependent variables were vocabulary learning and vocabulary learning retention.

Participants and Inclusion Criterion

Initially, using WhatsApp Status and Instagram story, one of the researchers who is a language teacher in Tehran, called English language learners to attend free online vocabulary courses. Around 80 English language learners volunteered to take part in the study. To ensure the homogeneity of the participants, they took The Oxford Online English -Vocabulary Level Test (VLT) and only students with one standard deviation above and below the mean were selected. Consequently, 37 upper-intermediate students aged between 22 and 32 years met the inclusion criterion. Later on, when the study proceeded, the number of participants shrank to 30. Thus, data gathered only from 30 participants was considered for data analyses.

The sample size was calculated through the Morgan formula (39):

$$n = \frac{x^2 N p (1 - P)}{e^2 (N - 1) + x^2 p (1 - P)}$$

The result indicated 23.904. Therefore, the sample size of the current study which was 30, was appropriate.

Instruments

Vocabulary Level Test of Oxford Online English

The Oxford Online English -Vocabulary Level Test (VLT), designed by Oxford Online English, was utilized to find out about the participants' vocabulary proficiency levels (levels were categorized based on the Common European Framework of Reference for Languages: A1, A2, B1, B2, C1, and C2). The vocabulary section of VLT entails 40 multiple questions that are available at OXFORD Online English Level Test (<https://www.oxfordonlineenglish.com/English-level-test/vocabulary>). The test is a standardized and validated test by oxford university press.

Novelty Test (Pretest)

The novelty test, which acted as pretest as well, was taken from the vocabularies of Beaven's 4-series books "The Image Building English Vocabulary with Etymology Introduction". Since students had to be taught and examined only on unknown words, the Novelty test was administrated in order to select 105 vocabularies (based on frequencies of either wrong answers or no answers). After the test, only the unknown words were chosen to be taught via three different techniques of teaching vocabulary. The results of posttest for each technique were compared with each other; therefore, the changes in the number of words learned by the participants in each type of treatment could be representative of the result of the independent variable. After the treatment, the results of posttests were compared to the novelty test and each other.

Posttests and Delayed Posttests

The posttests and a delayed-posttests were prepared based on the instructed vocabularies of each group. The items were taken from Building English Vocabulary with Etymology from Latin, Book 1 (available online: <http://www.cheshirepress.com>). To ensure the content validity of the items, they were given to two experts in TEFL. The 15-matching

items of posttest were administered to assess vocabulary learning outcomes and the other 15-matching items of delayed posttest were conducted to investigate the retention outcomes.

Data Collection Procedure

The Control Group

A group of 37 students was created on WhatsApp to be notified about the Google Meet link. They were exposed to English vocabulary teaching one hour twice a week for six weeks. The participants received conventional vocabulary teaching. Selected vocabularies of each session were typed with their definitions, parts of speeches, examples, and relevant activities in PowerPoint slides which were shared on the Google Meet's screen and students read and answered the teacher's questions. They were given 15 minutes to do activities and ask any questions. The teacher helped and corrected them when needed while they were reading their answers.

The First Experimental Group

In the first experimental group, only 33 participants were exposed to gamified vocabulary teaching one hour twice a week for six weeks, because 4 students did not turn up for the rest of the experiment. They received the same vocabulary instruction of control group on Google Meet within 5 sessions, whereas they were required to enter their own Kahoot's code to do gamified activities. Considering the limitation of Kahoot, as a free user for the number of players (10 players), participants were divided into 3 groups of 11-players (labelled A, B, C). Students played researcher-tailored-game (specified for the relevant vocabularies of each session) as the gamified activities. The players had the opportunities to have immediate feedback to their responses in Kahoot. The top five players getting the higher point indicated on the Kahoot's leaderboard. Participants were notified that have the accessibility to the game to practice more and take advantage of different features of Kahoot including practice, study, flashcard, pronunciation, and

game in order to change their position on the leaderboard to get the position of the top three players.

The Second Experimental Group

In the second experimental group, the number of students shrank to 30 and 3 more students did not complete the experiment. They participated in one-hour sessions every other day for two weeks. The etymological-based instruction was employed to run 5 sessions including giving definitions and examples along with decoding of each word (prefix, root, suffix) on Google Meet. Students were permitted to join Kahoot and play the researcher-customized game based on the etymological vocabulary instruction and put efforts to become the top three winners on Kahoot's leaderboard. As it was mentioned earlier, due to limitation of free-user on Kahoot, students were divided into three 10-member groups. Students were informed about the availability of the games on Kahoot along with its mentioned features. Figure 1 includes detailed information about the procedure.

Statistical Method

To meet the first aim of the study, whether there was any significant difference in the control and the experimental groups scores, descriptive statistics and one-way analysis of variance (ANOVA) were utilized. ANOVA was utilized because there were more than two means to compare. To apply ANOVA, first the normality test of Kolmogorov-Smirnov was run to find out whether data was distributed normally and whether parametric tests could be applied ($\text{sig} \geq 0.05$). Having made sure that the normality condition was met, the means and standard deviations of the two experimental groups as well as the control group were calculated. To evaluate the differences, the Post hoc Scheffe test was applied. It should be noted that SPSS version 22.0. was performed.

Results

In order to find out whether there were

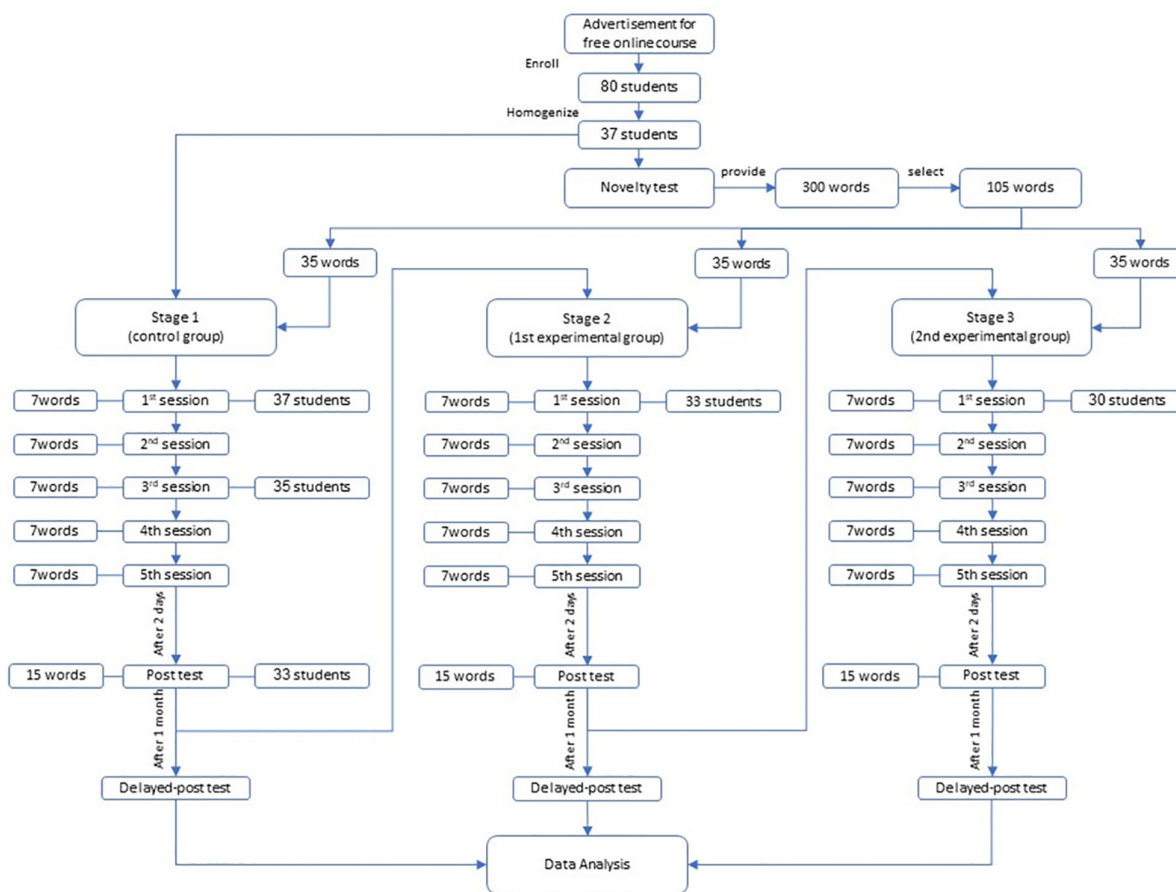


Figure 1: The diagram of the procedure

Table 1: Descriptive statistics for post and delayed posttest

Group	N	Posttest		Delayed Posttest	
		Mean	SD	Mean	SD
Control Group	30	11.10	1.53	9.73	1.68
Non-etymological Game Group	30	12.00	2.33	9.93	1.99
Etymological Game Group	30	13.16	1.17	12.40	1.83
Total	90	12.08	1.92	10.68	2.19

differences among the groups in the posttest, having made sure that the normality condition was met, the researchers first calculated the means and standard deviations of the two experimental conditions, namely the non-etymological game group and the etymological game group, and control group on the vocabulary posttest. The results are shown in Table 1.

As depicted in Table 1, descriptive statistics results indicated that the mean score gained by the etymological game group was higher than the other two groups. It was found that the etymological game group (M=13.16, SD=1.17) outperformed the control

group (M=11.10, SD=1.53). Moreover, it can be seen that the other experimental group, the non-etymological game group, gained a mean score higher than the control group (M=11.10, SD=1.53). Besides, between the two experimental conditions, the etymological game group (M=13.16, SD=1.17) showed an advantage over the non-etymological game group as it could gain a mean score which was higher than the non-etymological game group (M=12.00, SD=2.33). Yet, at this stage it was not clear whether the observed discrepancies between groups were statistically significant. Thus, in order to figure out whether these differences were statistically significant or

not, an Analysis of Variance (ANOVA) test was run. The results are illustrated in Table 2.

As Table 2 depicts, the results of the one-way ANOVA on the vocabulary knowledge after the treatment yielded significant differences among the performances of the learners in various conditions in the posttest, $F(2, 87)=10.50$, ($P=0.001$). By the same token, the results of the ANOVA on the delayed posttest indicated significant differences among the performances of the learners in various conditions, $F(2, 87)=19.52$, ($P=0.001$). Next, to find out where the difference lay, post hoc Scheffe's tests were carried out on both posttest and delayed posttest. The results of the post hoc Scheffe's are shown in Table 3.

As Table 3 shows, in the posttest, the Etymological game group could significantly outperform both the non-etymological game group ($P=0.040$) and the control group ($P<0.001$). Moreover, the difference between the non-etymological group, and the control group was found to be significant ($P=0.048$).

Moreover, in the delayed posttest, a statistically significant difference was detected between the etymological game group and the control group ($P<0.001$). However, the other experimental condition, the non-etymological game group was not

found to significantly outperform the control group ($P=0.915$). Besides, between the two experimental conditions, it was found that the etymological game group could gain a mean score which was significantly higher than the non-etymological game group ($P<0.001$).

Discussion

The purpose of this study was to evaluate the effectiveness of two versions of online games on English vocabulary learning of Iranian EFL learners. The outcomes revealed that there was a significant difference among the three groups (control, non-etymological game, and etymological game) in that the etymological-gamified group outperformed the other groups significantly and the non-etymological game group put up a better performance than the control group in the post-test. To examine the retention of words, the results of the delayed posttest indicated the significant effect of etymological based game over the other two groups.

The findings of this study are justifiable regarding Dual-coding Theory of Paivio (11). Due to the combination of game and etymology as visual and verbal aspects of treatment respectively, etymology-based game led to the best performance of the participants.

Table 2: One Way ANOVA, tests of between-subjects effects, for posttest and delayed posttest

	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Posttest	Intercept	13152.71	1	13152.71	4287.85	0.00
	Group	64.42	2	32.21	10.50	0.001
	Error	266.86	87	3.06		
	Total	13484.00	90			
Delayed Posttest	Intercept	10282.71	1	10282.71	3033.21	0.00
	Group	132.35	2	66.17	19.52	0.001
	Error	294.93	87	3.39		
	Total	10710.00	90			

Table 3: Scheffe's Test for posttest and delayed posttest

	Group	Non-etymological game	Etymological game	Control
Posttest	Non-etymological game		-1.16* ($P=0.040$)	0.90* ($P=0.048$)
	Etymological game	1.16* ($P=0.040$)		2.06* ($P<0.001$)
	Control	-0.90* ($P=0.048$)	-2.06* ($P<0.001$)	
Delayed Posttest	Non-etymological game		-2.46* ($P<0.001$)	0.20 ($P=0.915$)
	Etymological game	2.46* ($P<0.001$)		2.66* ($P<0.001$)
	Control	-0.20 ($P=0.915$)	-2.66* ($P<0.001$)	

*The mean difference is significant at the 0.05 level.

It could be argued that employing the etymological information can be stored in memory alongside the visual form which can provide an extra path for retention and recall. The results are consistent with the results of Boers, Eyckmans, and Stengers (12) who reported that engaging the Dutch-speaking learners' minds in combinations of more senses can lead to better results in learning. In their study, they conducted a series of experiments that were set up with the participation of students of English in higher education. The results indicated that knowledge of the origin of idioms can effectively help learners comprehend their figurative meaning. They claimed that the problem-solving task of inferring idiomatic meaning on the basis of etymological information is feasible and it facilitates recall, too.

In the present study, comparing the results of the posttests showed that gamified vocabulary learning in non-etymological game and etymological game performed better than non-gamified vocabulary learning. The results are in line with those of the study conducted by Robson (2015) who pointed out that Gamification takes advantage of game design elements. These elements are summarized as the eight basic gamification elements, utilized in online game learning. Similarly, another 173-player study conducted by Hamari (17) indicated that engagement played an important part in having a positive effect on learning. Besides, in Lam's (39) study it was pointed out that learners preferred online games to worksheet in terms of reviewing vocabulary because learners' interest were captured by gamified vocabulary learning. The findings also corroborate the previous findings of similar studies that have demonstrated that in terms of vocabulary retention, learners who learned vocabulary through online games performed better in retaining (39). Considering Lam's (39) study, there was a common request by learners to have more questions to play in the game that was in light of enthusiasm for vocabulary learning through gamification. Furthermore, the findings of the present

study indicating that etymological gamified treatment in delayed posttest outperformed non-etymological gamified treatment are in accord with those of Zolfagharkhani and Moghadam (10) who conducted a study using 60 English learners majoring English within 20 to 28 years of age both females and males in Iran. Zolfagharkhani and Moghadam concluded that Iranian EFL students in the experimental group in which etymological treatment was applied, outperformed the control group.

The results of this study are partly in accord with the results of Yip and kwan (30), as in their study, time limit might have distracted learners and frustrated them while learning vocabulary via games, meaning that the restriction of time throughout the non-etymological-based treatment diverted the learners' concentration from retention. Additionally, Hamari and Kiovisto (16) claimed that although positive effects of gamification are inevitable, the effects are highly dependent on contexts and players.

The results of the present study are not in agreement with some other researches which claimed that incorporating games in vocabulary learning did not make any significant differences. For example, Furdu, Tomozei, and Köse (40) declared that by playing games, students might commit errors and interpret errors as a failure and become frustrated. Moreover, when the assignment changes into an obligatory one by teachers, students will identify games as tedious exercises. In the same line, Martí-Parreño, Seguí-Más, and Seguí-Más (41) reported that lack of some resources including time and financial backing in gamifying the activities and exercises can lead to disadvantageous circumstances in learning. They also reported that some students do not consider games as proper learning tools and, therefore, games could assist some subjects, but not all. In the same vein, Calongne and Hiles (42) pointed out that the creation of virtual spaces can be costly and expends time and, therefore, might lead to unfavorable circumstances. Moreover, digital games, as Gentile, Choo, Liau, Sim,

Li, Fung, and Khoo (43) claim, are not always successful materials to include in education as they claimed that learners, especially the young ones, can become hooked to them.

Limitations and Suggestions

This study experienced some limitations and delimitations that need to be considered in generalizability of the results. One of the delimitations of this study was the number of participants. Given that this study was conducted during Covid-19 pandemic and lockdowns, the number of participants was small; therefore, the replication of the study using a larger number of participants as well as other proficiency levels is recommended. Furthermore, exploring the learning and retention of other components and skills of second languages can be addressed in further studies. The study can also be replicated by comparing different genders.

Conclusion

The study has highlighted the potential benefits of incorporating games and verbal language aspects to improve language learning. In particular, the results have shown that combining the two forms of information processing can lead to superior outcomes in the acquisition and retention of new vocabulary. The etymological game group demonstrated significantly better performance, which indicates the positive impact of integrating mental imagery created by games with the verbal aspect of etymology. This result highlights the importance of using a combination of cues to enhance memory recall and deep learning. Additionally, it seems that the use of games and problem-solving activities can contribute to increased motivation and interest in language learning. Engaging learners in fun and enjoyable activities has been shown to enhance engagement and promote long-term retention.

Moreover, the study suggests that promoting learners' interest in the fun side of learning can lead to more positive attitudes towards the learning process. By introducing an enjoyable and engaging element to

language learning, learners may become more motivated to persist with their studies and develop a deeper understanding of the language.

Overall, the findings suggest that incorporating games and verbal language aspects can be a powerful tool in language learning. By combining different forms of information processing and incorporating enjoyable activities, learners can improve their language proficiency and develop a deeper understanding of the language. This approach may be particularly effective for learners who struggle with traditional language learning methods, as it offers a more engaging and interactive learning experience.

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Authors' Contribution

All authors (GA, FH, and FT)) conceptualized the study, and all were major contributors to writing the manuscript. All authors approved the final manuscript.

Conflict of Interest: None declared.

Ethical Considerations and Participants Consent

This research was conducted with the consent of the participants. They were also assured that all information collected will remain confidential. The authors declare that they have no conflict of interest. The study was approved with code: (IOI. T1158003).

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The Impact of Podcasts on Students' English Vocabulary Knowledge and Satisfaction: A Quasi-Experimental Study

Mostafa Amiri^{1,2}, PhD; Hashem Rastegar³, MA; Nematullah Shomoossi⁴, PhD; Behrooz Ghoorchai^{5*}, PhD

¹Department of General Courses, School of Medicine, Gonabad University of Medical Sciences, Gonabad, Iran

²Department of English Language and General Courses, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

³Department of English, Golestan Science and Research Branch, Islamic Azad University, Gorgan, Iran

⁴Sabzevar University of Medical Sciences, Sabzevar, Iran

⁵Department of English, Farhangian University, Tehran, Iran

ABSTRACT

Background: Using podcasts has long been the source of benefit in education. Podcasts are now used for learning and teaching; however, some aspects are still uncovered. Therefore, this study aimed to determine the effect of using podcasts as instructional tools on English as a Foreign Language (EFL) learners' vocabulary knowledge and satisfaction towards listening to podcasts.

Methods: In this quasi-experimental study, a vocabulary pre-test was given to 60 males intermediate EFL learners from Iran Language Institute (ILI) in Gonbad-e Kavus city, Iran, from October to November, 2017, to check their homogeneity regarding their vocabulary knowledge. Then, they were divided into two experimental and control groups, each with 30 participants. The experimental group was instructed by the use of podcasts, but the control group continued with routine instruction. They were given a post-test to examine their knowledge of vocabulary. Also, to find out the students' satisfactions towards podcasting, a 5-point Likert scale questionnaire with 8 items was given to the participants in the podcasting group. In addition to the Likert-scale questionnaire on their satisfaction, face-to-face interviews using probing questions were conducted with 8 participants. The collected data were analyzed through Statistical Package for Social Science (SPSS) version 20 using t-test. The p-value was considered at 0.05 level of significance.

Results: The results revealed that the podcast group outperformed the control group in the post-test. The mean±SD for the control and experimental groups were 14.10±1.29 and 16.66±0.92, respectively (P=0.001). Then, the thematic analysis revealed four themes: (1) vocabulary achievement, (2) learning by listening, (3) learner choice and flexibility, and (4) podcasts as useful instructional tools.

Conclusions: The findings suggest that podcasts enhance learners' vocabulary learning, thus emphasizing the pedagogical merits of podcasts in the enrichment of EFL classes. The results may provide implications for curriculum development and second language vocabulary teaching and learning.

Keywords: Learning, Education, Distance, Research, Information Technology, Vocabulary, Satisfaction

*Corresponding author:

Behrooz Ghoorchai, PhD;
Department of English,
Farhangian University,
Tehran, Iran

Tel: +98 9112722062

Email: behroozghoorchai@gmail.com

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Introduction

During the past two decades, the term 'podcasting' has come into vogue on the stage of mass media and was noted as the 'word of the year 2005' by the New Oxford American Dictionary. Probably, Hammersley coined the term "podcasting" for the first time to denote both "iPod" and "broadcasting" (1). In fact, podcasting refers to a web-based audio content delivery approach (2). Tending to be played on any digital audio player, podcasts are one of the newest trends in online instruction and co-occurs with other routes of instruction such as e-learning, mobile learning, and web-based learning technologies and also in medical education (3). Now, they can be automatically downloaded via a subscription feed (an automatic downloading process) (4). A simple web search will render a long list of podcasts with a wide range of topics for young and adult learners, elementary or advanced learners, and so on. These days, the popularity of podcasting has enormously increased.

Historically, it is known that human beings were accustomed to listening as a primary source of learning for thousands of years. Besides, as Cebeci and Tekdal (1) stated, learning by listening to authentic speech holds one of the most effective pedagogic advantages offered in podcasting (5). Therefore, listening appears more attractive and less boring than merely reading; it can also motivate students who do not like reading. Such unique features are appropriately integrated into 'podcasting', i.e. instruction by 'talk' rather than 'text'. ELT podcasts are particularly suggested for 'extensive listening' (6), where motivating students in listening activities and providing them with exposure to native speech are the focus and priority.

According to students' and teachers' perceptions, the use of '*audiovisual resources and new technologies*' was one of the 19 motivational strategies Madrid (7) explored. In this regard, podcasting as a preferable technology in computer-assisted language learning (CALL) and mobile-assisted language learning (MALL) is a promising

tool, particularly for EFL contexts, where poor exposure to authentic and native communication may hamper learners from achieving higher levels of motivation and proficiency (3). Also, Ajabshir and Sadeghi (8) have held that CALL can be relied on as a scaffolding technology to increase vocabulary knowledge by L2 teachers, practitioners, and course designers.

The application of podcasts in learning and teaching has its pros and cons. Some scholars are doubtful about its advantages. For example, Cann (9), using quantitative and qualitative analyses, reported that audio podcasts were not popular with students; and even there have been doubts that podcasting might not significantly affect learning outcomes. On the contrary, other researchers considered podcasting a success. For instance, Kurtz, Fenwick, and Ellsworth (10) reported remarkable gains in students' final project grades; Evans (10) claimed that university students were more receptive to podcast-based learning materials than to traditional lectures or textbooks; students also found podcasts to be more effective revision tools than textbooks, and considered them more efficient than personal lecture notes.

Still, other scholars attribute further potential to podcasts (2, 11, 12), stating that podcasting brings flexibility to school and university learning; listening to recorded lectures, in particular, allows students to access and review lectures offline at convenient times. Also, the use of podcasts is suggested to supplement traditional textbooks by adding authentic listening materials (2, 12). In EFL contexts, learners may also find useful communicative aspects of the language in a podcast, e.g. idioms, phrasal verbs, grammatical structures, etc. (13). Other advantages include one's exposure to a range of different voices, accents, and social and academic situations. Podcast-based activities may successfully cater to two varieties of English (i.e. formal and informal English), which is a highly neglected aspect in EFL contexts.

Currently, there are few published reports

of EFL classes using and integrating this technology into their instructional materials. Therefore, the present study aimed to investigate the impact of using podcasts as instructional tools on Iranian EFL learners' vocabulary learning and to evaluate their satisfaction towards listening to podcasts. Accordingly, the following research questions were shaped whether listening to podcasts affects the participants' vocabulary learning and what are the participants' satisfactions and viewpoints toward listening to podcasts?

Methods

Trial Design

Both quantitative and qualitative methods were used to answer the research questions and further explore the students' satisfactions and viewpoints about podcast-based vocabulary expansion. Quantitatively, the pretest-posttest quasi-experimental design was used to examine the impact of podcasting on Iranian EFL learners' vocabulary knowledge and learning. Also, to triangulate the data, we elicited the students' satisfaction towards the effect of the program on their vocabulary learning using a 5-point Likert- questionnaire with 8 items. Moreover, qualitatively, the participants' viewpoints about podcasting were elicited via semi-structured interviews with eight participants from the experimental group.

Participants and Setting

The participants of the study were selected using convenient sampling; we had only two groups which were randomly assigned as experimental and control ones. Using a vocabulary pre-test, we randomly divided the participants into two classes: class A as the experimental group (n=30) and class B as the control group (n=30) because the groups' performance regarding their vocabulary knowledge was not significantly different at the beginning of the course. They were 60 male intermediate EFL learners whose demographic data (i.e. age, and past learning experiences) were collected through a questionnaire at the beginning of the semester

in October, 2017. Their age ranged from 16 to 22 years old; none of the participants had experience with podcast-based vocabulary expansion; in addition, they needed to be willing to participate to be included in the study. They had all practiced vocabulary using traditional methods in previous classes. They were learning English at a well-reputed Iranian language institute, i.e., Iran Language Institute (ILI), in Gonbad-e Kavus, Iran. ILI is a network of language institutes in most cities of Iran with predetermined syllabi for various levels of learners. The participants' level of English was not determined by proficiency tests; rather, based on the ILI placement test, intermediate-level learners were included in the study. Also, the participants were excluded from the study if they did not fill out the study questionnaire or did not attend the interviews.

Data Collection Tools

To obtain the desired data quantitatively, we used the following tools: (1) a 20-item researcher-made vocabulary test (used as both a pre-test and post-test), the vocabulary test enjoyed a reliability 0.85 (using Cronbach alpha coefficient) and a validity of 0.80 as estimated by the researchers, and (2) an 8-item Likert scale questionnaire was conducted solely for the experimental group to elicit the participants' satisfactions, with enough space for comments if they wished. The Cronbach alpha coefficient reliability of this questionnaire was 0.84, and the questionnaire had an acceptable validity index of 0.88, too. Finally, to discover the participants' perceptions of the impact of podcasting on learning vocabulary, eight students from the experimental group were interviewed after the course.

Intervention

Knowledge Assessment

The vocabulary pre-test was administered to both groups in the first session at the beginning of the course and before the intervention to determine their vocabulary knowledge as the starting point, and the

vocabulary post-test was performed at the end of the course after the intervention.

The experimental group was instructed by listening to podcasts. For this group, the classes were held twice a week for 90 minutes, and the course continued for five weeks from October to December, 2017. In ten successive sessions, podcast-based materials were introduced and taught to participants in the experimental group. The podcasts were played and intensively practiced in the classroom, mostly to make sure that participants had listened to the materials at least once. Listening to each podcast took about 15 minutes each session, followed by vocabulary exercises practiced for about 10 minutes on average. Then, they were encouraged to carefully listen to podcasts several times at home.

In the control group, however, vocabulary was taught by routine instructional methods without podcasts, and the course included two 90-minute sessions each week for five weeks similar to the experimental group, as practiced by the institute throughout the years. Meanwhile, the control group was taught by the ILI routine techniques of teaching vocabulary, which is mostly considered to be a modified version of audiolingual methodology with a considerable focus on grammar and drills for teaching dialogs with meager intensive work on vocabulary expansion.

Participants' Viewpoints

Following the data collection quantitatively, individual semi-structured interviews which totally lasted about two weeks were conducted to explore the experimental group participants' satisfactions and viewpoints about the podcasting module. The interview session for each participant lasted about one hour. The interview questions were shaped by a review of the related literature and the expert opinions of some colleagues. The participants were requested to choose to answer the questions either in English or Farsi (their mother tongue or L1). For the interviews, eight students (four students with higher vocabulary

scores and four with lower vocabulary scores) with varying vocabulary abilities from the experimental group participated to cater for varying opinions. In the semi-structured interview, we started with a general question: "What is your viewpoint about using this podcast?" and then continued with the probing questions including challenges, the strengths, and weak points.

The interviews stopped at the point of data saturation as the interviewer felt that the participants' answers to the interview questions were nearly similar. Then, the interviews were transcribed, and inductive thematic analysis was utilized; the reported themes emerged from the data. In other words, the validity of the data was determined by transcribing and analysing them by the authors and a panel of experts in the field where some themes emerged. The themes were discussed, and the final ones were accepted by the authors and the expert opinion of some colleagues.

Data Analysis

The data were analyzed using SPSS version 20 through the following statistical methods: (1) a one-sample Kolmogorov-Smirnov test to ascertain the normal distribution of the data, (2) independent sample t-test to compare the mean performance of the control and experimental groups before and after the intervention for the vocabulary knowledge, (3) descriptive analysis (percentage) for the satisfaction questionnaire and content analysis of the participants' answers to the satisfaction questionnaire, and (4) the content analysis for analysing the result of the open questions of the semi-structured interviews.

Results

First, to ascertain the normality of the distribution of the data, a one-sample Kolmogorov-Smirnov test was run. The p values for the pretest scores of the control and experimental groups were 0.33 and 0.24, respectively. Since the P-values were above 0.05, a parametric test was used.

Vocabulary Knowledge

The independent t-test was run to see whether the experimental group performed better than the control group in the vocabulary pre-test. Based on the independent t-test analysis, the pretest scores of the two groups were not significantly different (P=0.85). In other words, the groups were homogeneous in terms of their vocabulary ability at the beginning of the study, and the mean scores of the control and experimental groups were 12.13 and 12.07, respectively. In the post-test, the independent samples t-test showed that the mean score of the experimental group (16.66) was greater than that of the control group (14.10) (Table 1). That is, the mean±SD for the control and experimental groups were 14.10±1.29 and 16.66±0.92, respectively (P=0.001). Moreover, the table indicates that the p-value of 0.001 is much lower than 0.05, implying that the difference between the obtained means is statistically significant. Therefore, the null hypothesis which stated that “using podcasts does not significantly affect students' vocabulary learning” is

rejected. In other words, podcasts affected the participants' vocabulary learning.

As shown in Table 1, the mean score of vocabulary knowledge increased in both group after the intervention, but this increase was more effective in the podcast group.

The Likert Scale Questionnaire

The participants' satisfaction level towards podcast-based vocabulary expansion was elicited via a researcher-made 8-item questionnaire. When the instruction was over, 30 participants in the experimental group were given the questionnaire and asked to tick the Likert choices; they expressed their satisfactions as follows: *strongly agree, agree, no idea, disagree, or strongly disagree*. In addition to Likert scale statements, the questionnaire allowed some space for respondents to provide open-ended comments if they wished to add any comments. They were also assured of the confidentiality of their views and personal information. The responses were entered into Excel for analysis and reporting of the percentage. The analysis

Table 1: Comparison of the podcast and control group in terms of vocabulary knowledge

	Group	N	Mean±SD	Std. Error Mean	P value
Pre-test scores	Control	30	12.13±1.35	0.24790	0.85
	Experimental	30	12.07±1.36	0.24883	
Post-test scores	Control	30	14.10±1.29	0.23659	0.001
	Experimental	30	16.66±0.92	0.16838	

Table 2: The participants' satisfaction towards podcast-based vocabulary expansion

Item No	Statement	Strongly Agree/Agree	No idea	Strongly Disagree/Disagree
1	I often feel bored when listening to podcasts.	6.67%	26.67%	66.67%
2	I like to learn English listening comprehension mainly through podcasts because listening is very important.	60.00%	16.67%	23.33%
3	I feel that I can learn through podcasts.	86.67%	6.67%	6.67%
4	I would like teachers to use podcasts in my classes.	70.00%	16.67%	13.33%
5	I like listening to podcasts.	70.00%	16.67%	13.33%
6	To improve my English vocabulary comprehension, I will spend much of my studying time listening to podcasts.	36.67%	16.67%	46.67%
7	I often feel nervous and uncomfortable when listening to podcasts.	16.67%	20.00%	63.33%
8	I am sometimes unable to focus on and understand the content of the materials when listening to podcasts.	50.00%	26.67%	23.33%

of the eight items is presented in Table 2, and the comment or the content analysis regarding each item follows the table.

Content Analysis

Item 1: Three students commented that at first, listening to podcasts seemed to be tiresome, but gradually they really enjoyed listening to them, especially when they discovered new spoken idioms and expressions in the content of podcasts. One of them commented, *"I sometimes came up with expressions I was long looking for; it was just what I wanted in these years."* Another participant commented, *"Podcasts are interesting because it discusses the most important subjects and gives information about different cultures."* A student, however, commented that he felt bored because he could not focus on the content.

Item 2: There were two comments about this question. One learner said that *"Vocabulary is an important ability, but podcasting is only one way; I found other ways for improving my vocabulary."* The other participant said, *"My vocabulary isn't good. I like to be better, so I will listen to everything which helps me. And listening to podcasts is so cool."*

Item 3: There was only one comment on this question. One participant said, *"Speakers of this podcast file were so great. They were like classroom teachers. I sometimes feel they are in the classroom teaching me. But I could not just ask them questions."*

Item 4: One student commented, *"Podcasts are so funny and they teach me interesting and useful things. I thank my teacher to use them in the classroom."* Two other students believed that *"podcasts are new and different from what they had already learned in previous classes."*

Item 5: To this item, three students put their written comments. Two of them agreed with the idea that podcasts had motivated them to listen more. However, one student did not like the idea of listening to podcasts. He stated: *"They are so boring, so I don't like listening to them. They are so easy, too. Honestly*

speaking, it was a waste of time for me."

Item 6: Some students noted that there were other aspects of language which they needed to spend more time on. One student said he had a little problem with vocabulary; therefore, he needed to spend most of his time practicing other skills. One student commented that the course was useful in integrating podcasts, and from then on, he started listening more to podcasts to practice vocabulary in the future.

Item 7: Six students commented on this statement. While, one of them wrote: *"I started well first, but after just two minutes I couldn't focus on the content. It's so hard to understand everything"*, some others believed that they had no or few problems when listening to podcasts.

Item 8: There were six short comments on this statement. All of them implied that they sometimes had problems understanding the content of the materials.

The Verbal Interview Analysis

To explore the participants' real perceptions of the impact of podcasting on Iranian EFL learners, we interviewed four students with low vocabulary scores and four with high vocabulary scores from the experimental group after the course. The interviews continued to the saturation point, where the interviewer came to the understanding that the interviewees' answers were being similar and repeated. The length of the interviews varied between thirty and fifty minutes depending on the interviewees' willingness and eagerness to talk, and the interviews altogether took about two weeks to complete. The interviews were transcribed verbatim and analyzed thematically; the following themes emerged from the data: (1) *vocabulary achievement*, (2) *learning by listening*, (3) *learner choice and flexibility*, and (4) *podcast as a useful instructional tool*, which will be explained below.

Theme One: Vocabulary Achievement

In the interviews, the students expressed their ideas about their improvement in

vocabulary expansion. Unanimously, they reported higher gains in vocabulary scores. They also believed that they had been empowered in learning new vocabulary items more effectively and had developed sharp ears for spoken language; one said, *"I am sure from now on I would have no problem listening to different listening materials if they are not much above my level, knowing the vocabulary and expressions."*

Some of them stressed that they had gained more confidence in listening to longer stretches of speech such as stories or lectures. One student said, *"The podcasting program helped me to willingly listen more by giving me more confidence and motivation in comprehending and by forcing me to do a lot of listening practice to improve my vocabulary."* Although almost all participants felt that the podcasting experience helped them improve their vocabulary comprehension, they believed that they still needed more practice to achieve real proficiency.

Theme Two: Learning by Listening

Some interviewees believed that the process of 'learning by listening' was an advantage compared to reading textbooks. In this regard, one of them said, *"To sit down and to read is very challenging; you have to be stuck in one place for a long time. But audio materials are not like that. It is easier to learn when we listen, especially when you understand everything."* Another participant said, *"I think it is the best way to improve our pronunciation. We can listen to words and we can check the pronunciation of all words; in this way, I can check or learn pronunciations of a lot of words because everything is so fast and I don't need to check them in my dictionary."*

Another participant focused on the fact that listening to podcasts gave them an effortless and relaxed option to access ample information in general – all they had to do was to listen; he further added, *"It was so great that how easy it was for me to access information on various topics; just listen to it and learn a lot of cultural notes and*

different hints on English usage. Actually no pain, all the gain!" As previously mentioned in section 3.1, none of the participants had the experience of using podcasts for learning. However, they agreed that podcasting was such a new phenomenon for them. One of the interviewees pointed out that learning with podcasts represented a new and attractive experience, *"That is a very fresh experience. In fact, I'd never heard of a podcast before this class; I didn't even know what podcast was."*

Theme Three: Learner Choice and Flexibility

Many interviewees expressed that podcasts were flexible and convenient because the learners could listen to them at a convenient place, time, and pace of their choice. The following comment reflects the potentiality of podcasts on different occasions, *"It looked for me as if I was listening to music. Listening to music is my favourite hobby. I have a lot of small free time which I can't do anything else, so I used to listen to music. But now I can also like to listen to podcasts."* A similar idea came from another participant, *"I sometimes listened to podcasts when working with my computer."* Similarly, a participant added, *"I can listen to podcasts every time I like or I am free such as when I am on the bus or in the car and I can't do anything else. Thus it is very good to learn English at such times because I have to learn English very soon."*

Theme Four: Podcasts as Useful Instructional Tools

The last major theme emerging from the data was the participants' opinion about the auxiliary contribution of podcasts as instructional tools for extra-curricular learning. One of them said, *"Podcasting provides me additional exposure to learning English. I think I need to practice more and more."* Another learner added, *"There are a lot of vocabularies and I should do a lot of listening to become better in vocabulary comprehension. By using podcasts, I can practice vocabulary at home."* Having experienced the podcasting project, the

learners were aware of its advantages and disadvantages. As for the advantages of the program, one of the students commented that podcasts had made him somehow independent in terms of listening and vocabulary learning. Some of them found podcasting useful for speaking ability too because they were able to pause after each sentence and repeat the same as a model. Interestingly, they preferred using new technology to traditional methods of vocabulary since in this type of learning they could feel the presence of an amazing educational technology; one said, *"I am tired of using my cell phone for just messaging and listening to music. Now, I have another application for it. I am happy to use it for my English learning."*

However, some participants preferred to point to disadvantages, too. Almost half of the interviewees said that some podcasts were lengthy and not interesting enough. Even one participant regarded 'making students listen to podcasts more than once as a useless activity. One of the participants said, *"They (14) were so easy, so it was a very boring job to listen to them more than once. I think they are useless when they are very easy"*. Another disadvantage they highlighted was the lack of pictures and videos to accompany the audio files. One learner rightly criticized that podcasts were just one-way learning objects with no interactional possibilities, and added, *"We cannot interact with files; we must just listen to them and when we have questions, we cannot ask them. But, when we listened to them in class, that was no problem."*

Discussion

The present study was conducted to investigate the impact of using podcasts as instructional tools on EFL learners' vocabulary learning and to evaluate their satisfaction towards listening to podcasts. The results showed that 'listening to podcasts' improved the learners' vocabulary scores in the experimental group. Therefore, podcasts could be used in language classes, on the one hand, to help teachers and learners with

improving auditory skills and vocabulary expansion (15), and on the other hand, to boost students' classroom motivation (3, 11). In fact, the present study demonstrated the potentiality of using podcasts to foster EFL learners' English vocabulary learning and expansion, which is in line with the findings of the earlier studies (15, 16).

The results of the qualitative analysis showed that podcasts can be considered supplementary instructional tools to improve the students' overall vocabulary scores. These findings are in line with those of the previous studies (12, 15) since the participants reflected positive perceptions due to the ease and convenience of using podcasts; or because they gained motivation to practice more listening materials (11), which are really rich with new vocabulary items in context (17, 18), or because they encouraged 'active learning and listening' (14).

Also, in response to the Likert scale questionnaire, the majority of the participants decided to continue to practice listening to podcasts in the future. Based on this survey, 88% of the participants 'felt that they can learn through podcasts'. Furthermore, 70.59% liked the podcasting experience. To enrich the study findings, we conducted semi-structured interviews, and relevant themes appeared as (1) *vocabulary achievement*, (2) *learning by listening*, (3) *learner choice and flexibility*, and (4) *podcast as useful instructional tools*. Their positive satisfaction and viewpoints are also in line with those of the earlier studies (1, 6, 14, 15); they also found that podcasts could be used in educational settings in general and language teaching in particular to motivate students. Moreover, the point that podcasts can further motivate learners is frequently mentioned in the literature (11, 17, 18). However, our results contradict some earlier studies. For example, contrary to Cann and Kelly et al. (9), the participants of the present study welcomed podcasts in their classes and stated that podcasts were beneficial learning tools for them, and they were enabled to learn through listening to podcasts. Another possibility of podcast usage is for teachers to

adopt them as means of communicating with students (12).

The role of podcasting which is regarded as a useful technology in computer-assisted language learning (CALL), and mobile-assisted language learning (MALL) is of utmost importance, especially as a promising tool, a finding which is supported by the results of the present study. This is true of the EFL contexts, where poor exposure to authentic and native communication may hinder the learners from achieving higher levels of motivation and proficiency in their attempts to learn a language (12). Moreover, the findings pointed out that the learners positively perceived podcasts in listening and vocabulary learning, a finding which corresponds with those of the studies conducted by Asyifah and Indriani, and Saeedakhtar, Haqju, and Rouhi (12).

Limitations and Suggestions

This study bears implications for teaching and curriculum development in EFL contexts. First, podcasts should be given due attention because of their auditory advantages, specifically learning vocabulary by listening practice. Second, EFL teachers are recommended to integrate podcasting exercises in their classes. Third, EFL learners might find a chance to practice becoming more responsible and autonomous in improving their vocabulary. However, the limitations of podcasting for learners who do not feel at home with it should be re-considered before its integration into the course syllabus. Forth, the other limitation of the study is the recruitment of only male students in the study. Finally, a larger sample size in future studies, with a wider scope of gender and proficiency levels may help clarify the points we have not been able to consider.

Conclusion

Based on the results, 'listening to podcasts' can improve EFL learners' vocabulary scores; the use of podcasts in language classes helps teachers with improving auditory skills and vocabulary instruction and leads to higher

vocabulary scores and positive satisfactions. However, the retention of vocabulary gain is an aspect raised by researchers (12) which requires special attention. Also, benefiting from the interactive advantages of the new technologies (19), most EFL learners may start practicing with podcasting experience due to positive feelings, satisfactions, and viewpoints.

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Authors' Contribution

BG and HR devised the study concept, designed the study, supervised data collection and analysis, and critically revised the manuscript. HR, MA, and NS collected the data, ran the study intervention, participated in the study concept, performed the analyses, and revised the manuscript. HR conducted the interviews. BG, NS, and MA contributed to the design and analysis of the study data and drafted the manuscript. All authors contributed to the draft and approved the final manuscript.

Conflict of Interest: None declared.

Ethical Considerations and Participants Consent

This study was conducted as a master's thesis in humanities, at Science and Research Islamic Azad University, Golestan Branch, for which a confirmation code was obtained, but we did not apply for the ethics code at that time nor was it mandatory for the studies in the humanities fields. The approval code for the master's thesis is 67920312922024.

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Evaluation of Virtual Education Challenges at COVID-19 Pandemic in Iran: Practical Solutions for Optimal Usage at the Educational System

Rahim Moradi^{1*}, PhD;  Behnam Rasouli², PhD

¹Department of Educational Sciences, Faculty of Humanities, Arak University, Arak, Iran

²Department of Educational Science, Faculty of Psychology and Education, University of Allameh Tabataba'i University, Tehran, Iran

ABSTRACT

Background: By closing university and educational centers due to the pandemic outbreak of Coronavirus, E-learning achieved prominence. The technology advances in this field, moreover, have caused fundamental changes in many approaches, including learning assessment methods. Therefore, this study aimed to identify the challenges of evaluating E-learning in the Coronavirus era and provide practical solutions for the optimal usage at the educational system in Iran.

Methods: This is a qualitative and research synthesis study. The inclusion criterion was the studies indexed in national and international databases, which were identified through a systematic search process. From 170 studies identified in the initial review stage, 100 were excluded from the analysis process due to the lack of sufficient information on the research objectives, repetitiveness, and unrelated research objectives. Then, in the content review, 70 researches were examined, and finally 20 studies which met the criteria for in-depth analysis were selected.

Results: The analysis of the selected studies showed that there were key challenges in the E-learning assessment such as validity and reliability, lack of real measurement of learning results, lack of real interaction between students and professors, technological challenges, and heavy workload for the teacher and learner.

Conclusion: According to the results of the research, it is suggested that an agenda should be set in educational systems for the training the professors with applying and integrating the new tools and technologies in the assessment of the students' learning.

Keywords: Learning, Education, Distance, Research, Evaluating challenges, Coronavirus, Practical solutions

*Corresponding author:

Rahim Moradi, PhD;
Department of Educational
Sciences, Faculty of
Humanities, Arak University,
Arak, Iran
Tel: +98 9372408016
Email: rahimnor08@gmail.
com

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Introduction

After the outbreak of the Covid-19 pandemic, health protocols emphasized social distancing (1). In that sense, in many countries, to reduce the spread of the Coronavirus, face-to-face training was suspended in schools and universities (2). Meanwhile, the closure, cancellations and restrictions of universities and educational centers as a response to the COVID-19 pandemic enhanced the importance of E-learning, and it promoted the schools and universities to provide the learners with virtual education instead of face-to-face classes (3). In other words, the growing spread of the Coronavirus in the world forced many countries to take measures, such as cancelling face-to-face activities in all educational levels and adopt the modern educational approaches through social platforms and E-learning tools (4). As a result of the educational advances, teachers and professors used these technologies to facilitate the learning process among the learners and produced creative and innovative learning opportunities. In other words, the technology progress in education created new forms of learning, one of which was Virtual Education or E-learning (2). Education and training experts believe that E-learning in the Coronavirus era has particular characteristics:

Unexpectedness: E-learning, due to unpredictable needs, was applied in educational centers without prior preparation (5). *Compulsion:* In many countries, it is imposed as an outstanding national measure (6). While distance learning was just a formality, now it is implemented as a necessity to confront the Coronavirus, and distance education has become , a “critical mission” (7). *Universality:* E-learning, as a worldwide reality, was used as a non-pharmacological intervention around the world (2). *Reputation:* It has become such a common interest in societies that dominates the public domain.

Pervasiveness: Before the Coronavirus spread, E-learning was mostly used in universities; nevertheless, today, it has entered the schools, in all educational levels and centers, as an educational approach (3).

Medical Emergency: Whereas the route impassability, remote areas, physical disability, and war were the deliberate reasons for virtual training usage, now it is used as a vehicle to deal with a global crisis in the field of public health (8).

Therefore, it can be said that the emergence and expansion of the computer and Internet technology provided the educational centers with new and powerful tools, so that they can achieve their institutional goals and create new and dynamic teaching-learning environments (2). Today, web-based distance education has received the attention of the most universities (9). E-learning provides the learners with opportunities to access materials and contents, participate in a collaborative learning environment, and obtain formative and cumulative feedback and assessment from professors (10). The learner, however, can voluntarily choose what, how, where, and when to learn (9); it leads to the realization of universal and public education (11). Since it has no need for physical facilities and classroom, the infrastructure costs are reduced (12); ultimately, it leads to information expansion and social interactions (11).

Moreover, learners and teachers can attend the classroom and use the educational facilities without being restricted to a specific time or place. E-learning facilitates teaching and learning features for learner-centeredness, context awareness, personalization, adaptability, interaction and immediate feedback, and assessment integration (13).

The assessment of learning by learners is, moreover, another important issue in electronic education environments. Some other issues that lead to challenges faced by E-learning include difficulties in the interaction between the instructor and the learner, use of technology to communicate with learners, workload and time management, possibility of getting feedback from experts, and the continuous need to collect a variety of assessment data (11). One of the basic concerns in this field is the quality of assessment. There are various roles and processes in E-learning design (14). According to Khan (15), E-learning consists

of several factors, including educational factors (education design, implementation and assessment), managerial and administrative factors (rules of registration, acceptance, documents, certificates, etc.), technical factors (software, hardware and user interface), support factors, and ethical factors.

Utilizing the information and communication technology in education, in addition to raising issues in both content and course materials transfer, leads to discussions about the possibility or impossibility of using traditional education tests on the Internet platform (11). Experts believe that as the systems of learning paradigms are different, and it is necessary to use methods and tools appropriate to each paradigm to measure the learning of the learners in network-based education, similarly, such assessment methods should be used that are compatible with the nature of the education type and environment; since plurality and variety of the factors effective on distance education makes its structure complicated, it causes concerns for teachers and learners (12).

In addition, teachers cannot monitor, in online classes, the educational activities of learners for a long time, or react to their questions, points of view, and non-verbal behaviors; thus, they have to explore other techniques to receive the expected information (15).

However, virtual learning environments have various facilities and capabilities that can help to apply effective methods and strategies to truly measure the learning of learners (11). Experts believe that E-learning has limitations, for example, it may not be able to supersede the teacher attendance, human emotional interactions, and face-to-face communication in the classroom (16).

In various researches, however, following E-learning challenges has been mentioned in general; Beleulmi in his study (17) refers to delay in feedback from the instructor, lack of social feeling, and feeling of isolation as disadvantages of E-learning courses. The author acknowledges that these disadvantages can be the result of the lack of effective

comprehensive interaction with the instructor (15). The lack of interaction and support service program for the learner can be considered as the challenges that lead to the feeling of isolation, lack of self-regulation, and reduced motivation.

Al-Maqbali and Raja Hussain (18) in their research examined the challenges of E-learning assessment, and the results showed that challenges included heavy teaching workloads, cheating, lack of online assessment tools, false or false identity/inauthenticity, lack of assessment measure for practical experiences, plagiarism, grade inflation, teamwork assessment, scientific authenticity and great number of students in every section. Also, Maatuk et al. (19) in a study mentioned that large physical distance, teaching problems, assessment problems, and copyright are the challenges with which E-learning is faced (18).

The widespread use of E-learning during the outbreak of Coronavirus, therefore, has faced the professors and teachers with challenges in E-learning assessment. A review on the related researches revealed that there was no independent research, using a Research Synthesis method, on identifying the challenges of E-learning assessment in Coronavirus era. Therefore, carrying out research which can suggest a general framework of challenges of E-learning assessment and their applicable solutions and identify the shortcomings of previous researches can help to plan and set policies in the field of educational system. For this end, we aimed to identify and discover the challenges of E-learning evaluation and present a conceptual model of the existing studies in this field.

The following questions were posed:

1. What are the challenges of E-learning evaluation in the era of Coronavirus
2. What are the solutions of these challenges for the optimal use of the educational system in Iran?

Methods

The current research was conducted as a

qualitative study using the research synthesis and systemitised review method. Research synthesis pays attention to previous relevant theories, critically analyzes the findings in a specific field, and tries to resolve the conflicts in the literature and determine the main topics for future research (19, 20). In other words, research synthesis integrates the current knowledge and research findings related to a subject in order to generalize and apply the existing findings, and develop new knowledge by an integration process (21).

To systematize the research process, we used the seven-step method of Sandelowski and Barroso (22) as follows:

1. *Setting the research question;*
2. *Performing a systematic review of the sources;*
3. *Searching and selecting appropriate sources;*
4. *Extracting data from the findings;*
5. *Analyzing and combining the findings of the investigated sources;*
6. *Performing quality control, and*
7. *Finding presentation.*

Therefore, based on this method, the question of who, when, and how was raised, as clarified below. The research data (who) includes articles indexed in national and international databases. In order to access the background and collect data appropriate to the purpose of the research (systematic review of sources), studies were selected from national databases such as Megairan, Normagz, Civilica, Research Institute of Humanities, Iran profile, and international databases such as Scopus Science Direct, ProQuest, Eric, Springer and Google Scholar. Keywords in the systematic search of international databases: E-Learning, Virtual learning ,Online learning OR /And challenges, Barriers, Problems OR / And Assessment, evaluation.

Criteria for Selecting Articles

In order to achieve the goal of the research, we considered the literature published in the last 10 years in international researches, and for the last 8 years in national researches. Also, all articles of scientific journals, seminars and conferences, theses and doctoral dissertations were included in the results. Book chapters, newspaper articles, general magazines,

reports and editorials were, nevertheless, excluded from the search process. In all stages of the review, from the title and abstract to the full text, until reaching the final articles for analysis. The related criteria of articles: related to virtual education, related to E-learning, related to electronic education, related to the publication year 2012 and later for international researches, related to the publication year 2014 and later for natinal researches, public interviews and reports. The unrelated criteria of articles: unrelated to virtual education, unrelated to the Coronavirus era, lack of research in education or higher Education, publication years older than 2012 for international research, publication years older than 2014 for natinal research, published in authoritative scientific journals and magazines and theses and Ph. D dissertations.

Systematic Search Output

In the process of searching and selecting articles, as shown in Figure 1, after the initial search in reliable databases, 170 studies were identified. In the process of searching and screening the articles, the current sources were reviewed according to the title, abstract, and content. We, moreover, used the Critical Appraisal Skills Program (CASP) method as quality check list to evaluate the quality of the articles. The main assessment criteria, in line with the analysis of the articles and reaching the goal of the research, include the relevance of the item title, item topic, its up-to-dateness, accuracy of the findings and results, and the overall value of the item (how). In addition, the independent variable criterion for E-learning assessment, in order to consider its effects and time period, was from 2012 to 2022. From all the included studies, 100 studies were excluded from the analysis process due to insufficient information concerning research objectives, repetitiveness, and lack of relevance to the research objectives. Also, in the next stage review, some researches were excluded from the review process due to not mentioning the challenges of E-learning assessment. Subsequently, 25 items were selected from

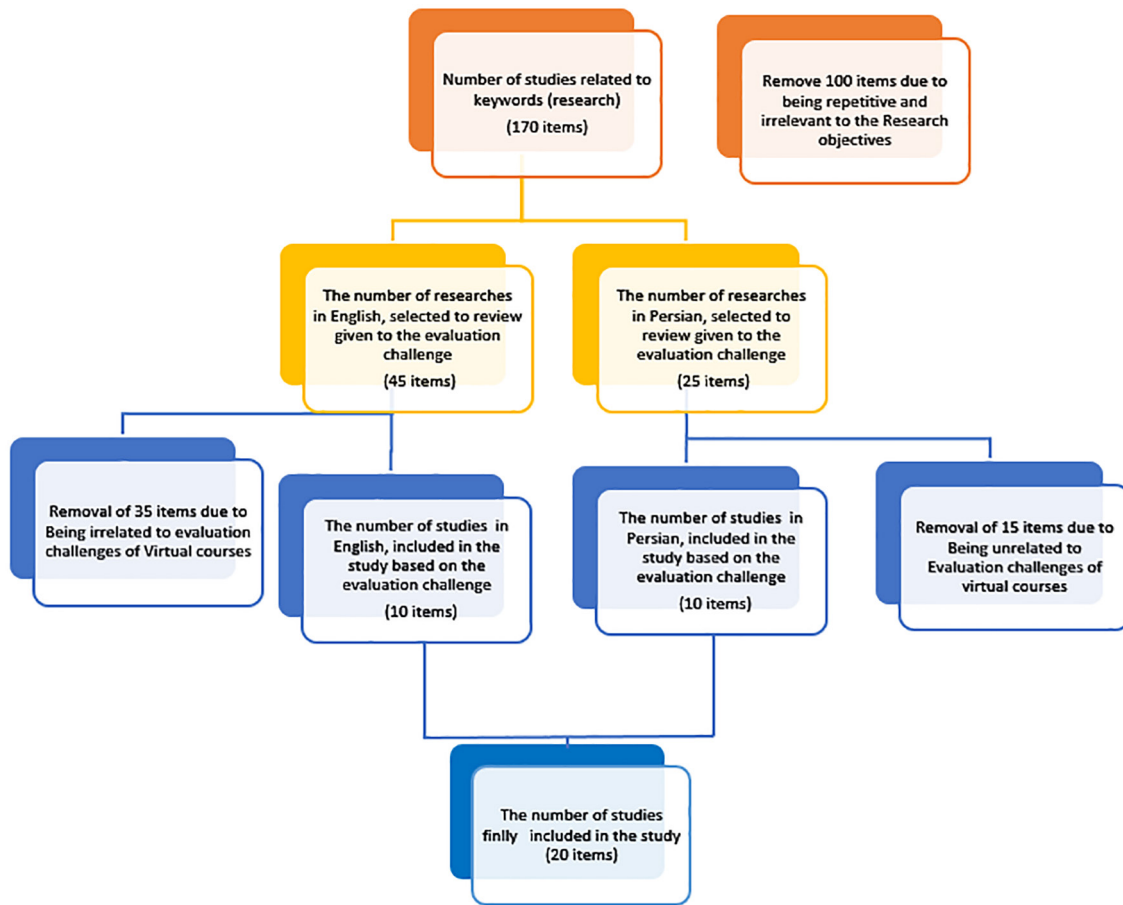


Figure 1: Chart of the review and selection process of the items during the systematic review

the national database from 2012 to 2022, and 45 items were selected from international databases, from 2012 to 2022. Finally, we obtained the required data, 20 samples were purposefully selected and analyzed, according to the criteria of research, title, abstract, and body of the text. The data and results of the research findings were classified and analyzed

in two dimensions of open concepts and core (main) categories. The data and sources used were refined and extracted in several stages. After analysis and combination of the results, a concept was presented in a conceptual framework (Figure 2).

In order to ensure the validity and reliability of qualitative studies, we used two methods

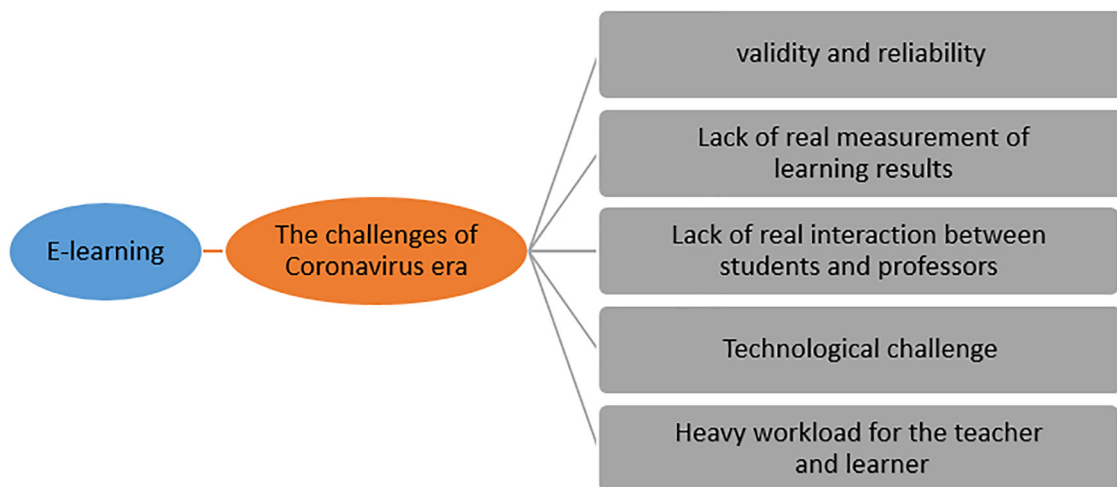


Figure 2: Challenges of E-learning assessment at COVID-19 Pandemic

Table 1: Kappa coefficient obtained from agreement

Symmetric Measures				
	Kappa value	Asymptotic Standard error	Approximate TB	Approximate Significance
Measure of Agreement	Kappa 0.63	0.99	6.54	
N of Valid Cases				

a. Not assuming the null hypothesis; b. Using the asymptotic standard error assuming the null hypothesis

of member control and Kappa coefficient in the current research (Table 1). The obtained analysis and interpretations were evaluated by two experts active in the field of coding and qualitative research, and their accuracy was confirmed. The Kappa coefficient obtained was also obtained by two evaluators (the author and an expert). The analysis of the selected items was carried out according to the assessment challenges in E-learning, summarization of the results, and interpretation of the researchers (analysis and presentation of findings).

Result

In accordance with the method of the current research, which is qualitative and research synthesis, the analysis and interpretation of the data was carried out as follows:

Initially, 20 studies were selected as a sample according to the theoretical saturation of the data, which had the most harmony and appropriateness with the research objectives. After selecting the samples, the desired researches were carefully analyzed. Table 2 explains the characteristics of each

Table 2: Related research to E-learning assessment challenges in the university system in the era of Coronavirus

Code	Researcher(s)	Year	Research title	Research type	Findings
1	Beleulmi (17)	2022	Challenges of online assessment during Covid-19 Pandemic: An experience of Study Skills teachers	Qualitative	The results indicates that these teachers believe that online assessment was necessary and useful, especially during the quarantine period of the epidemic; however, they believe that they come with challenges due to non compliance with this assessment method, lack of face-to-face teaching, technical problems and academic inauthenticity.
2	Al-Maqbali & Raja Hussain (18)	2022	The impact of online assessment challenges on assessment principles during COVID-19 in Oman	Synthesis	When using online assessment, this study found challenges such as learners' refusal to turn on cameras, heavy teaching workloads, cheating, long time needed to develop online assessment tools, false identity/ inauthenticity, assessment of practical experiences, plagiarism, grades inflation, assessment of team-working, scientific authenticity and excess of students in each section. This study concluded that these challenges threaten the principles of validity, efficiency, fairness, reliability, and diversity, respectively.

3	Maatuk, Elberkawi, Aljawarneh, Rashaideh & Alharbi (19)	2022	The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors	Qualitative	Challenges include physical distance, teaching problems, assessment problems and copyright.
4	Almeida & Monteiro (23)	2021	The challenges of assessing and evaluating the students at distance.	Review	To the teachers, there is a lot of concern about adopting models free of cheating and excessive focusing on the collective assessment component, which is less superior in the distance education model compared to the processes of gradual monitoring and assessment of students. There is, also, Challenge in human and social interactions. To the students, there are issues with equipment to track training sessions, and concerns about their privacy, especially when intrusive IT solutions request them to access to their cameras, audio and desktops.
5	Aboagye, Yawson & Appiah (24)	2021	COVID-19 and E-learning: The challenges of students in tertiary institutions	Correlative	The most important challenges include social, teaching, academic and general issues.
6	Zalat, Hamed & Bolbol (25)	2021	The experiences, challenges, and acceptance of e-learning as a tool for teaching during the COVID-19 Pandemic among medical universities staff	Survey	The majority (88%) of staff agreed that the technological skills of online course delivery increased the educational value of the college staff experience. Participants' agreement on perceived usefulness, perceived ease of use, and acceptance of electronic training was 77.1% 76.5% and 80.9% respectively. The highest barriers for e-learning were insufficient/unstable internet connection (40%), insufficient computer labs (36%), lack of computers/laptops (32%), and technical problems (32%), respectively. The most important indicators influencing the acceptance of e-learning included low age, teaching experience of less than 10 years and being male.
7	Chamasemani & ehtesham (26)	2021	E Designing a conceptual model of factors affecting the quality of university virtual education and evaluate its quality during the COVID.19 pandemic	Blended	The identified challenges include lack of attention to the appropriate infrastructure for education, lack of assessment of deep understanding, possibility of cheating, lack of assessment compatibility with teaching methods, lack of grading of semester activities and assignments, heavy workload for teachers, and lack of real phtsical experience.

9	Mosayebi, Rezapour Mirsaleh, & Behjati (27)	2021	The problems and challenges of E-learning during the outbreak of the Coronavirus in elementary school	Qualitative Phenomenology	By analyzing the data, E-learning problems were identified in the fields of "education", "teacher and school", "parents", "students", and "E-learning infrastructure"
9	Guangul, Suhail, Khalit & Khidhir (28)	2020	Challenges of remote assessment in higher education in the context of COVID-19: a case study of Middle East College	Survey	The main challenges identified in distance assessment were academic inauthenticity, infrastructure, coverage of learning outcomes and students' commitment to providing assessments. To minimize academic inauthenticity, the best approach includes preparing different questions for each student.
10	Seifert (16)	2020	Student assessment in online learning: Challenges and effectiveness practices during Covid-19.	Review	The challenges included validity and reliability, rules and regulations, lack of familiarity with educational technology and shortage of technology and tools.
11	Mahyoob (29)	2020	Challenges of e-Learning during the COVID-19 Pandemic Experienced by EFL Learners	Survey	It is found that the main problems affecting online language learning and during COVID-19 are related to technical, academic and communication challenges. The results of the study show that the majority of English language learners are not satisfied to keep on online learning, because they cannot meet the desired improvement in language learning performance.
12	Sadati, Nouri, Hajfiroozabadi, & Abjar (30)	2020	Faculty Members' Experiences About Virtual Education Opportunities and Challenges During The Covid-19: A Qualitative Study	Qualitative	The investigation resulted in the extraction of two main classes as follows; 1) " individual obstacles in effectiveness of E-learning, with subclasses: "personality characteristics and family factors " 2) "Organizational management" with subclasses of "infrastructure provision, management and leadership, training and supervision, ethics and law and assessment".
13	Alborzi, Mohammadi, Naseri, Safari and Mirghafari (31)	2020	Elementary School Teachers' Experiences of the Challenges of Changing Traditional Education to Virtual Education during the Corona Virus Outbreak	Qualitative	The assessment challenges include the ; slow internet and the lack of access to proper internet, the lack of monitoring of students' academic progress, the increased possibility of student cheating, the time-consuming nature of assessment for the teacher, the lack of belief in online assessment, and the human and social interactions.

14	Rahbar Karbasdehi & Rahbar Karbasdehi (32)	2020	E-learning of students during the 2019 Coronavirus epidemic: problems and solutions.	Analysis	The identified challenges include lack of appropriate feedback, insufficient reality, time-consuming, academic inauthenticity.
15	Hajizadeh, Azizi and Kihan (9)	2020	Analyzing the opportunities and challenges of e-learning in the Corona era: An approach to the development of e-learning in the post-Corona	Phenomenology	The assessment challenges includes lack of verification and holding of examinations, lack of trust in students in taking the test, stress of students, fatigue, lack of real and authentic assessment, lack of recognition of the learning accuracy, lack of accurate information on the extent of student learning, lack of receiving feedback
16	Rezaei (10)	2020	Student learning evaluation during the Corona: Challenges and Strategies	Qualitative	The identified challenges include time-consuming, possibility of cheating, lack of face-to-face communication, fatigue, failure to send answers on time, internet disruption.
17	Salimi & Fardin (33)	2020	The Role of corona virus in virtual education, with an emphasis on opportunities and challenges	Blended	At the macro level, the challenges include the lack of strategic thinking of managers and planners, unfavorable policies, imperfections in educational technology and inefficient management; At the intermediate level, the challenges include imperfections of the introduced technologies, lack of independence and action freedom, and disruption of budgeting allotted.
18	Roshani Ali Bena See, Fathi Vajargah, K & Khorasani (34)	2017	The Challenges of the Quality Evaluation of Virtual Education Curriculum: The Case of Shahid Beheshti University	Descriptive	The results showed that the quality of e-learning curriculum assessment faces challenges in both managerial-executive and definitional-professional dimensions.
19	Zamani, Parhizi & Kaviani (35)	2015	Identify challenges of evaluating students' academic performance e-courses.	Survey	The results showed that, from the point of view students, the biggest challenges in the E-courses assessment include technical issues 3.71%, pedagogical issue 3.2% and psychological issues 3% respectively.
20	Kearns (14)	2012	Student assessment in online learning: Challenges and effectiveness practices	Survey	The results showed that the most important challenges included physical distance, inauthenticity and technological gap.

research, which includes the year, researcher name, title, type, and findings of research. In the next step, by coding and classifying the categories, we extracted the assessment challenges of the E-learning, and the main categories and themes. Then, we selected and named 50 open codes as the themes. Subsequently, we selected 5 axes as the

main (core) categories in axial coding (Table 3). Also, Table 4 presents the frequency of assessment challenges in E-learning shared between the investigated researches. By combining the core categories to the design, we set out the conceptual framework of the assessment challenges in the E-learning (Figure 2).

Table 3: Assessment challenges in E-learning in the educational system during the Coronavirus era in selected researches

Codes	Open coding	Axial coding	The main/central category
1-2-3-4-7-8-10-11-14-15-16-17	Academic inauthenticity - cheating, false identity – plagiarism – copyright - educational inauthenticity - validity and reliability - lack of verification		Validity and reliability
1-2-4-5-7-9-11-13-14-15-16-18-19	lack of assessment of practical experiences and team-working - real assessment problems - lack of expected progress in learning performance - lack of assessment of deep understanding - lack of grading activities and assignments throughout the semester - lack of monitoring of students' academic progress - lack of appropriate feedback - lack of real and authentic assessment - lack of accurate information on the extent of student learning, failure to receive feedback - pedagogical issues		Lack of real measurement of learning results
1-2-3-4-10-11-14-16-17	Students' refusal to turn on the cameras - lack of real physical experience - reduction of human communication - eliminating the sense of real interaction - challenge in human and social interaction - communication challenges- physical distance - lack of monitoring the academic progress of students - lack of face-to-face communication		Lack of real interaction between students and professors
1-3-4-6-8-9-10-11-13-14-17-18-20	Technical problems - equipment problems - insufficient/unstable internet connection - infrastructure - Lack of technology and tools - technical challenges - technological gap, lack of attention to proper infrastructure - E-learning infrastructure, slow internet and lack of proper internet access - failure to send answers on time - internet disruption, technology imperfection		Technological challenge
1-4-11-15-16-17-19-20	Heavy teaching workload - teaching problems - teacher's problems - heavy workload for the teacher - time-consuming - fatigue - executive and psychological problems		Heavy workload for the teacher and learner

Table 4: The frequency of assessment challenges in shared E-learning among the research sample in the present study

No	The core category	The code of related research	Frequency
1	Validity and reliability	1-2-3-4-7-8-10-11-14-15-16-17	12
2	Lack of real measurement of learning results	1-2-4-5-7-9-11-13-14-15-16-18-f19	13
3	Lack of real interaction between students and professors	1-2-3-4-10-11-14-16-17	9
4	Technological challenge	1-3-4-6-8-9-10-11-13-14-17-18-20	13
5	Heavy workload for the teacher and learner	1-4-11-15-16-17-19-20	8

After analyzing the studies, from the total collected and coded information, categories close to each other were placed in a core (main) category. According to Figure 2, the challenges of E-learning assessment in the Coronavirus era include five main components (core category as follows:

1. *Validity and reliability* include the sub-components of academic inauthenticity - cheating, false identity – plagiarism – copyright - educational inauthenticity - validity and reliability - lack of verification (the study codes: 1-2-3-4-4-8-10-11-14-15-16-17)

2. *Lack of real measurement of learning results* includes the sub-components of lack of assessment of practical experiences and team-working - real assessment problems - lack of expected progress in learning performance - lack of assessment of deep understanding - lack of grading activities and assignments throughout the semester - lack of monitoring of students' academic progress - lack of appropriate feedback - lack of real and authentic assessment - lack of accurate information on the extent of student learning, failure to receive feedback - pedagogical issues (the study codes: 1-2-4-5-7-9-11-13-14-15-16-18-19)

3. *Lack of real interaction between students and professors* includes the sub-components of students' refusal to turn on the cameras - lack of real physical experience - reduction of human communication - eliminating the sense of real interaction - challenge in human and social interaction - communication challenges- physical distance - lack of monitoring the academic progress of students - lack of face-to-face communication (the study codes: 1-2-3-4-10-11-14-16-17)

4. *Technological challenge* includes the sub-components of technical problems - equipment problems - insufficient/unstable internet connection - infrastructure - lack of technology and tools - technical challenges - technological gap, lack of attention to proper infrastructure - E-learning infrastructure, slow internet and lack of proper internet access - failure to send answers on time - internet disruption, technology imperfection

(the study codes: 1-3-4-6-8-9-10-11-13-14-17-18-20)

5. *Heavy workload for the teacher and learner* includes the sub-components of heavy teaching workload - teaching problems - teacher's problems - heavy workload for the teacher - time-consuming - fatigue - executive and psychological problems. (The study codes: 1-4-11-15-16-17-19- 20)

Discussion

The current study aimed to synthesize the challenges of E-learning assessment in the Coronavirus era and provide practical solutions for the optimal educational system in Iran. The findings research showed that the challenges of the E-learning assessment in the educational system included validity and reliability, lack of real measurement of learning results, lack of real interaction between students and professors, technological challenge and heavy workload for the teacher and learner. In this regard, Rezaei (10) mentioned challenges such as time-consuming nature, possibility of cheating, lack of face-to-face communication, fatigue, failure to send answers on time, and Internet disruption.

Result of Moustakas and Robrade's (36) research showed that teachers reported difficulties in motivating students, especially if there was no visual communication. Finally, even with innovation, variety and interactivity, the practical and social nature of sport and physical education did not fully translate into online settings.

Also, Al-Maqbali and Raja (18) in their research mentioned such challenges as the learners' refusal to turn on cameras, heavy teaching workloads, cheating, long time needed to develop online assessment tools, false identity/inauthenticity, assessment of practical experiences, plagiarism, grades inflation, assessment of team-working, scientific authenticity, and great number of students in each section.

Maatuk et al. (19) in their study, discussed the challenges such as physical distance, teaching problems, assessment problems,

and copyright. Also, Aboagye et al. (24) mentioned the social, teaching, academic, and general issues as the most important challenges.

Muhie, Tesfay and Tamirat (37) in their research, also, mentioned challenges such as lack of technological skills, high costs of e-learning incentives, lack of strategies, lack of computers, culture of university teaching and learning process, and students' fear of being in a new environment.

In explaining these findings, it can be said that face-to-face assessment strategies in the classroom do not underlie the online or combined learning contexts, but they require changes in the assessment approaches, tools, and mentality. It can be more difficult to track and triangulate observations, conversations and learner products, and threaten the validity of the assessment in order to assess the learning over time. Learners do not always have sufficient technical infrastructure for online learning and meaningful formative assessment, which raises the issue of equity. Authentic assessments and demonstrations of learning in the online context are more challenging (e.g. group projects and practical work), putting us at risk of returning to traditional summative assessments such as quizzes, exams, and essays.

Therefore, it can be said that professors and teachers need targeted and explicit professional learning in online education and assessment strategies because assessment and the method of online education are very different from face-to-face courses. Online assessments should be reliable, transparent, and feasible. Other key components include integrity, cheating prevention, privacy, and accessibility. Assessment techniques such as reports and projects are seriously subject to plagiarism. It may happen more when similar resources are available to learners, and there are fewer interactions with instructors. In oral assessment through video conference, lack of a strong and reliable Internet connection can cause qualitative problems in assessment. On the other hand, not all learning results can be measured using online assessment.

Learning outcomes assessed through written assignments may work well; they are not, however, sufficient for quality assessment. For example, it is difficult to assess group dynamics during a group presentation, when group members are in separate locations. Valid assessments of group projects, presentations, demonstrations, practical work, etc. can be more challenging in the online context (25).

Limitation and Suggestion

Since the researchers themselves were the tools of data collection, the possibility of bias in its results can be a limitation of the current research.

According to the results of this research, the following practical solutions can be proposed for the optimal educational system in Iran:

Set an agenda in educational systems for the training the professors with applying and integrating the new tools and technologies in the assessment of students' learning. Professors and officials should ensure that learners have the necessary software and hardware resources to work with this technology.

Provide multiple opportunities for the learners to participate in self-assessment, peer-assessment, joint problem-solving tasks, and teacher-learner discussions, so that teachers can gain relevant and appropriate insights into their learning process. Systematic design and presentation of educational materials can help the professors to choose appropriate assessment methods and technologies to increase learning.

Universities and educational centers can use probing tools that help to monitor the learners while taking the test. Other strategies to prevent cheating include timed open-book tests, scrambled question papers, low-risk tests with measures such as self-examination and individual performance assessment.

Professors should conduct regular peer reviews in which learners are asked to review the work of their peers. Such activities can motivate the learners to learn from each other. In addition, well-prepared activities such as

projects and group discussions can help the learners master the course material, and improve their collaboration skills.

Use strategies to receive accurate feedback from the learners for online assessment activities. Such strategies can include online surveys, weekly surveys, active management of discussion boards, etc. Divide large projects into smaller projects, so that learners do not feel fatigued. Design tools to monitor large numbers of learners, and also design rubrics to be used as self-assessment or peer review.

To perform performance assessment, educational centers should advise the learners to use appropriate and reliable hardware and software components to improve the quality of the assessment. To make the sessions more interactive, combine the related multimedia such as drag & drop activities, audio and visual assessments, picture-based activities.

Use the peer assessment method in E-learning with the aim of reducing the workload of the teachers. Peer assessment or peer evaluation is an educational approach that allows the learners to evaluate the level, value, and quality of their peer's comprehensive intelligent activity. Peer assessment usually involves providing feedback to peers' activities using criteria that are in the form of instructions.

Conclusion

Online assessments and exams are set in a digital environment; nevertheless, certain rules and regulations are still applicable to those assessments. Assessments operated in a virtual environment may require changes in strategies, approaches, and tools. For educators and professors, the lack of knowledge in using technology to evaluate the learners can threaten the quality of assessment and lead to poor time management. For learners who are not familiar with online tools, remote exams and other online assessment methods can be stressful. A reliable Internet connection and technical infrastructure is necessary for establishing online assessments. Not all learners may have sufficient resources needed for meaningful

assessment activities. If learners lack the required technical infrastructure, assessment through an online medium can be difficult. Online learning methods limit the direct interaction of learner-learner and learner-teacher. When learners and teachers are in the same place simultaneously, exchanging verbal commands is natural and feasible. Virtual learning environments may require planned structures to support communication and immediate feedback.

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Authors' Contribution

All the authors contributed equally to conceptualization, methodology, software, data curation, and writing the original draft preparation.

Conflict of Interest: None declared.

Ethical Consideration and Participants Consent

In this research, all the ethical issues were considered, such as introducing ourselves, a clear explanation of the purpose of the research, and the confidentiality of personal information. The study was approved with the code (1402/D/11103).

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A Survey Study on the Impact of Contextual Variables on Medical Students' Use of Health Messenger Media

Mehrvash Moradi¹, MSc;  Zahra Karimian^{1*}, PhD;  Nahid Zarifsanaiey¹, PhD

¹Department of E-Learning in Medical Sciences, Virtual School and Center of Excellence in E-Learning, Shiraz University of Medical Sciences, Shiraz, Iran

ABSTRACT

Background: Medical students receive health information from various media sources and messages. Receiving health information can have a significant impact on the students' dietary habits and healthy lifestyles. This study aimed to investigate the status of medical students' use of health media and messaging, as well as the contextual variables that affect it.

Methods: A survey study was conducted on 500 students of Shiraz University of Medical Sciences during September to December 2022 that were selected by simple random sampling. The research tool was a researcher-made questionnaire consisting of 15 items and six domains on a 4-point Likert scale, with a cutting point of 2.5. The validity of the tool was assessed using the CVI and CVR index, and its reliability was confirmed by internal consistency of 0.818. Data were collected through an e-questionnaire and analyzed using one-sample t-tests, independent t-tests, and ANOVA, using SPSS v.24 software.

Results: About 40% of the participants were male. 36.4% were BS students, 27.8% MD, 20.5% MSc degree, and the remaining were in the PhD program. 73.3% of the participants were single, 43.8% lived with their parents, and 28.8% lived in the dormitory. Among the types of health media, Internet searches (M=2.950), verbal conversations (M=2.394), scientific resources (M=2.236), and official health information websites (M=2.128) had the highest means, while mass media like radio and television were the lowest. Contextual factors such as age, field of study, place of residence, marital status, and educational level had a significant effect on the students' preference (P<0.05), but gender had no significant effect (P>0.05).

Conclusion: Students have access to the Internet and receive most of their information through this medium. Monitoring the sources and content of health information websites, as well as strengthening health media literacy among students, are of great importance.

Keywords: Distance, Science, Health, Student, Medical, Messaging, Media, Preferences

*Corresponding author:
Zahra Karimian, PhD;
Virtual School and Center
of Excellence in e-Learning,
Sadra and Sina Hall, Neshat
Street, Postal code: 71348-
14336, Shiraz, Iran
Tel: +98 71 32300037 (2021)
Email: Karimian@sums.ac.ir

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Introduction

Healthy lifestyle is among the most important tasks and the main concerns of governments (1), as healthy individuals are the basis of sustainable development (2). Among them, young people and students are very important groups whose health and quality of life are of great importance, as they play an important role in managing the future of society and their healthy habits and behaviors will have a significant impact on their quality of life in future (3). Various factors affect individual and social health, but people's reactions to disease, healthcare, and health-related behaviors are generally deeply influenced by messages conveyed through the media (4).

Messages are conveyed to the recipient with various objectives such as awareness-raising, persuasion, encouragement, anger, or calmness. Message design is a systematic and purposeful process of decision-making about the content and presentation of the message. Health messages are a category of persuasive messages designed to change individuals' behavior in the health domain. They can be used to change behaviors, such as smoking, increase physical activity and adherence to treatment regimens, and report disease cases to health organizations (5). People's reactions to disease, health care, and health-related behaviors are generally deeply influenced by messages conveyed through the media (4).

Although there are various ways to obtain health information, with the emergence of Internet technology, health information is more easily and quickly accessible to the public and helps them create positive health beliefs and behaviors, which in turn strengthens their health management (6). As a new medium, the Internet can disseminate health information and knowledge through various channels. This can persuade different target groups or individuals to accept the health knowledge presented and make it possible to improve public health (7). Scientific studies have shown that the use of media can have an impact on gaining health knowledge and individual health behaviors. For example, the "Stanford

Heart Disease Prevention Program" as the beginning of health communication studies widely shows that individuals who receive abundant health information through mass communication and those who have more contact with the media can easily change their health behaviors (8).

Social media can even intervene in individual behaviors to some extent and cover various disease prevention behaviors such as physical readiness, anti-smoking behaviors, and HIV prevention (9). Gough and colleagues (2017) examined health communications on social media and found that information can be presented perfectly through new media, humorous information can attract the users' attention, and educational information can be disseminated through users (10). The researchers investigated health literacy among residents of Beijing, China, and found that health behaviors had a positive association with repeated use of traditional media such as newspapers and television (11). Other studies have showed that and Individuals who use health-related media more have positive attitudes towards health (12).

People may receive health information from various media such as books, articles, family, or social networks (13-15). However, with the development of mobile technology as a ubiquitous tool in recent decades which is available to various groups and the possibility of individuals' participation in groups and social networks, this tool also has great importance in developing individuals' health information. A large number of people use m-Health platforms and social networks to receive health-related awareness, health self-efficacy, and social support (16).

According to Norman et al., (2007) electronic health interventions can be divided into several categories. The first category involves participants using computer-based content such as handouts, reports, and newsletters. The second category involves Internet-based education provided through email, CDs, and pocket computers. The third category involves the use of mobile phones as pocket computers, and users often

use messaging apps such as Telegram to exchange text messages, photos, videos, tags, sound, and files (17, 18). Mobile applications are practical programs designed for the users' use and installed on electronic devices such as smartphones and tablets (19). Messaging apps are, in fact, a category of practical applications or apps that allow individuals to communicate with others, discuss and exchange views, share images and videos they like, and have the opportunity to comment on the interests and topics of others as well as publish their own content according to their taste and opinion (20). Some of these apps include WhatsApp, Telegram, and Instagram. Messaging apps are one of the main strategies for delivering and enhancing health education (21) and, as they are of the same generation as students and young people, they are one of their main choices for exchanging information, including health information and health behaviors.

Evidence shows that students are not sufficiently concerned about their health and well-being, and because they are young and strong, they are less likely to pay attention to their health. Studies have shown that unhealthy behaviors are common among students. They have low responsibility for their own health (22); many skip breakfast (23), consume unhealthy foods (24), live a sedentary lifestyle (25, 26), and are potentially more susceptible to unhealthy lifestyles, smoking, unhealthy eating, increased stress, and physical inactivity (26). On the other hand, students have access to various communication and information tools, and they receive a significant portion of health information through various media. Identifying these media and student preferences can be effective in planning and managing the health and healthy lifestyle of students, especially since medical students are also health messengers and have an impact on the social awareness of other segments of society. This study aimed to investigate student preferences for the use of different health media and messengers and the underlying factors affecting them.

Methods

Study Design

This research was conducted using a descriptive survey method on the students of Shiraz University of Medical Sciences (SUMS), Shiraz, Iran during September to December 2022

Sampling

The statistical population of this research included all the students studying at SUMS in 2022 (about 5000 students). Using the Cochran formula (27) and based on the formula values: $N=5000$, study confidence level=95%, estimated error=0.05, z value=1.96, and p and q value of approximately 0.5 were considered, and the sample size was calculated using the following formula. The sample size was estimated to be about 357, but due to the low response rate of electronic questionnaires reported in previous studies, we sent emails to 550 students, and ultimately 500 completed questionnaires were returned. The sampling method was random sampling by drawing lots from the email list of students.

Inclusion and Exclusion Criteria

The inclusion criteria were all the students studying at SUMS in 2022, willingness to participate, and access to a mobile phone. The exclusion criterion was the samples that had not answered more than 20% of the questions.

Research Tool

The research tool was a self-made questionnaire consisting of 15 items and 6 components, including Academic Resource, Formal News and Information, Mass Media, Internet Search, Social Networks and Applications, and Informal Conversation. The content validity of the tool was confirmed using the CVI and CVR method (28, 29) by 10 experts in health education and medical education with a CVI= and CVR=values. Also, the construct validity of the tool was confirmed. The questionnaire was designed in a 4-point Likert scale, and the score range was between 1 and 4 with a cut-off point of 2.5.

Data Collection Method

After approving the research plan and obtaining the ethical code from the Ethics Committee of Shiraz University of Medical Sciences, and after coordination with the university, we obtained the email list of students with the permission of the Education Deputy. Then, an electronic questionnaire link was sent randomly to 550 students via email.

Data Analysis

To compare the mean of the total questionnaire and its components with the cut-off point or the expected minimum mean, we used the one-sample t-test, and the results were examined by background variables using independent t-tests and ANOVA. Additionally, the Pearson correlation test was used to examine the relationship between the components of the two questionnaires. SPSS 24 software was used to analyze the data.

Results

Based on the demographic characteristics of the research sample, a total of 500 complete questionnaires were collected. The demographic characteristics are presented in Table 1.

Examining the mean of the components, we found that among health media types, Internet search (M=2.950), informal conversation (M=2.394), academic resources (M=2.236), and formal sources of health information (M=2.128) had the highest mean, and mass media such as radio and television had the lowest role (M=1.701) (Table 2).

Among all the items, the use of content published on domestic (Iranian) social networks had the lowest usage, and the highest item was related to the portals and reputable health websites. (Table 3) It is worth mentioning that at the time of the research, the social network Telegram was filtered in Iran, and people were using it with a VPN.

Table 1: Demographic characteristics of the participants

Characteristics	Sub-categories	Frequency	
		N	%
Gender	Male	200	40
	Female	300	60
	Total	500	100
Age	18<Year<25	276	55.8
	26<Year<35	147	29.7
	36<Year	72	14.5
	Total	495	100.0
Field of Study	Clinical (Medicine and Dentistry)	125	25.0
	Basic medical Sciences (Biochemistry, Immunology, Physiology, Anatomy...)	85	17.0
	Para Medical (Nursing, Midwifery, Health care, Physiotherapy,...)	232	46.5
	None Medical Sciences (Computer, English language, Education,...)	58	11.6
	Total	500	100.0
Grade	BSc	181	36.4
	Professional Doctorate	138	27.8
	MSc	102	20.5
	PhD/Clinical Residents	76	15.3
	Total	497	100.0
Marital status	Single	366	73.3
	Married	134	26.7
	Total	500	100.0
Residential status	With parents	219	43.8
	Independent	137	27.4
	Dormitory	144	28.8
	Total	500	100.0

Table 2: Mean score of the use of Health Messenger Media from the of students' perspective

Components	Mean	SD	df	t	Sig
Academic Resource	2.236	0.795	499	-7.416	<0.001
Formal News and Information	2.128	0.901	500	-9.243	<0.001
Mass Media	1.701	0.573	500	-31.147	<0.001
Internet Search	2.950	0.773	500	13.000	<0.001
Social Networks and Applications	1.847	0.759	500	-19.262	<0.001
Informal Conversation	2.394	0.831	499	-2.849	<0.001

Table 3: Mean score of Health Messenger Media items from the students' perspective

Components	Items	Mean	SD
Academic Resource	Scientific books and articles	2.55	0.937
	Scientific conferences, webinars and meetings	1.93	0.896
Formal News and Information	Health messages and news from the Ministry of Health (SMS)	2.20	1.019
	The website of the SUMS or the Ministry of Health	2.05	1.011
Mass Media	Radio	1.36	0.614
	Television	2.15	0.968
	Public Magazines and newspapers	1.60	0.773
Internet Search	Search health related websites	2.69	0.935
	Search for information on Google	3.21	0.864
Social Networks and Applications	Health-related groups on WhatsApp	2.00	1.064
	Health-related groups on on Instagram	2.15	1.095
	Health-related groups on Telegram	1.94	1.051
	Health-related groups on local messengers	1.30	0.722
Informal Conversation	Conversation and exchanging news with the family	2.31	1.038
	Conversation and exchanging news with colleagues and classmates	2.47	0.898

Among the items, the highest mean score was related to searching for information on Google (M=3.21), searching health-related websites (M=2.69), scientific books and articles (M=2.55), and conversation and exchanging news with colleagues and classmates (M=2.47), while the lowest mean score was related to the use of domestic Iranian social networks (M=1.30) and radio (M=1.36).

The Use of Health Messaging by Demographic Variables

Age: According to the research results, individuals with higher age groups significantly used academic resources (P<0.001) and reputable websites related to the Ministry of Health, Treatment, and Medical Education (P<0.001) to obtain health information. Most individuals who searched the Internet were in the age range of 26-35

years (P<0.016). Regarding social networks and mobile-based applications, most students were from the age group of 18-25 years, and regarding informal methods (conversation with colleagues and classmates and family), most of them were from the age group of 26-35 years. No significant differences were observed in the use of mass media (P<0.455) (Table 4).

Field of study: As to the preferences of students for obtaining health information, by field of study, the preferences of students in different majors were significantly different in using formal sources (P<0.001), mass media (P<0.001), social networks and mobile-based applications (P<0.001), and informal sources (P<0.001), while no significant differences were observed in Internet search (P=0.493) and formal sources (P=0.092). The intergroup differences are shown in Figure 1.

Table 4: Comparison of the scores of using Health Messenger Media based on age groups

Components	Groups	N	Mean	SD	F	Sig
Academic Resource	18-25 Years	276	2.06	0.728	16.772	0.000
	26-35 Years	146	2.45	0.871		
	36-65 Years	72	2.50	0.721		
	Total	494	2.24	0.797		
Formal News and Information	18-25 Years	276	1.98	0.811	9.118	0.000
	26-35 Years	147	2.22	1.003		
	36-65 Years	72	2.45	0.933		
	Total	495	2.12	0.904		
Mass Media	18-25 Years	276	1.67	0.559	0.788	0.455
	26-35 Years	147	1.73	0.629		
	36-65 Years	72	1.72	0.513		
	Total	495	1.69	0.574		
Internet Search	18-25 Years	276	2.87	0.786	4.189	0.016
	26-35 Years	147	3.10	0.760		
	36-65 Years	72	2.90	0.720		
	Total	495	2.94	0.774		
Social Networks and Applications	18-25 Years	276	1.70	0.712	11.052	0.000
	26-35 Years	147	2.04	0.778		
	36-65 Years	72	1.95	0.782		
	Total	495	1.84	0.758		
Informal Conversation	18-25 Years	276	2.30	0.807	3.350	0.036
	26-35 Years	146	2.51	0.835		
	36-65 Years	72	2.47	0.899		
	Total	494	2.39	0.833		

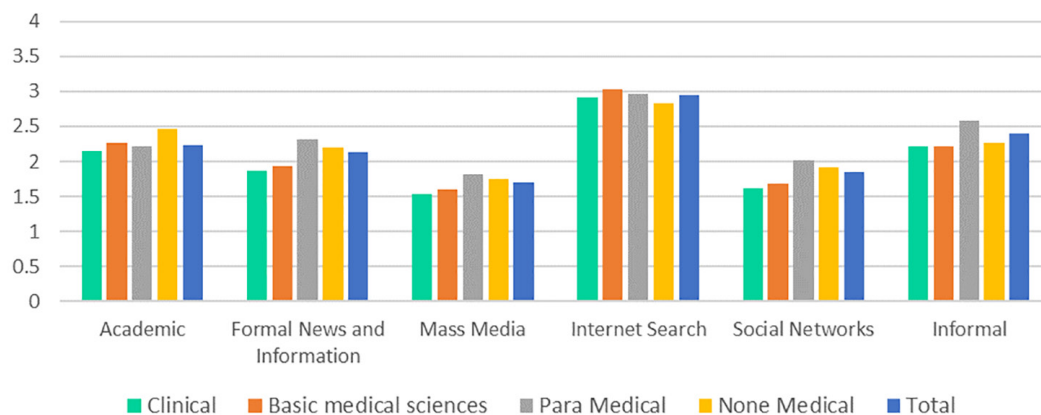


Figure 1: Comparison of the students' preferences of Health Messenger Media based on the fields of study

Gender: There was no significant relationship between the use of health messaging and gender.

Place of residence: Regarding mass media, individuals who lived with their parents used mass media more than other students ($P=0.004$), and there was no significant difference between groups in other communication methods.

Marital status: No significant difference was observed in Internet search and informal sources, but in the use of academic resources ($P=0.002$), formal sources ($P=0.001$), mass media ($P=0.013$), and social networks and mobile-based applications ($P=0.021$), married individuals sought more health information than single individuals (Table 5).

Table 5: Comparison of the scores of using Health Messenger Media by marital status

Components	Marital status.	N	Mean	SD	t	Sig
Academic Resource	Single	366	2.17	0.772	-3.092	0.002
	Married	133	2.41	0.832		
Formal News and Information	Single	366	2.05	0.842	-3.207	0.001
	Married	134	2.33	1.019		
Mass Media	Single	366	1.66	0.552	-2.480	0.013
	Married	134	1.80	0.620		
Internet Search	Single	366	2.93	0.785	-0.498	0.618
	Married	134	2.97	0.740		
Social Networks and Applications	Single	366	1.79	0.744	-2.308	0.021
	Married	134	1.97	0.786		
Informal Conversation	Single	366	2.35	0.824	-1.841	0.066
	Married	133	2.50	0.846		

Discussion

The present study showed that the highest mean usage of health messaging among students of Shiraz University of Medical Sciences was related to Internet searches, informal sources of conversation, scientific sources, and official sources of the Ministry of Health, respectively. Among these, students obtain the most health information through searching for information on Google, searching reputable websites related to health, scientific books and articles, friends and classmates, and finally, family members. These findings are consistent with the results of the study by Soroudi and colleagues (2021), which aimed to investigate the impact of social media use on depression in students of the School of Paramedical Sciences in Mashhad, and showed showing that students of SUMS obtain more information through the internet Internet and are very dependent on it for gaining information (30). The results of the study by Ghaffari and colleagues (2019) also support our research findings. In their study, which aimed to investigate the status of information dissemination and seeking by librarians of public libraries in Kerman province regarding health information, they stated that the main method of information seeking for librarians is was through the Internet, and they heavily rely relied on it for gaining information (31). Overall, improving awareness and dissemination of health information to students can contribute

to improving their own health and that of the community.

One of the justifications for this issue is the availability, wide application, and extensive coverage of information on the Internet, especially since Internet searches are often text-based and do not require specialized knowledge or a large Internet volume, and are easily accessible to various groups. Students can use their mobile phones to access the Internet and obtain health information when needed. Searching on Google and the web has no time or location constraints, and students can access information at any time and place with their mobile phones. This finding is consistent with the results of the study by Ghaffari and colleagues (2019), who stated that searching websites was one of the most important ways of obtaining information among students (31). In another study conducted by Bannor and colleagues (2017), the use of mass media for transmitting and receiving health messages was found to be much more effective than traditional media (32). Similarly, the findings of the present study are consistent with those of the study by Atkinson and colleagues (33). Overall, the availability of mobile phones provides an easier platform for searching for information, allowing the users to receive a vast amount of health information from health professionals and health-oriented organizations based on their needs. It also enables the individuals, whether sick or healthy, to communicate

with physicians and others to meet their information, emotional, and psychological needs (33). Indeed, some studies have had different results. In another study conducted by Tarnaha et al. (2021), the use of radio was found to be the best method for transmitting health messages, including alcohol abuse, drug abuse, smoking, and other related behaviors, good hygiene practices, use of contraceptive drugs, and avoidance of risky sexual behaviors (34). This finding was not consistent with those of our study, and the reason for this discrepancy may be different study populations in both studies. In the present study, the study population consisted of a group of young people who have a higher health literacy due to their medical education background and can often search for health information consciously; because they are mostly from the new generation, they are more familiar with the Internet. However, the general audience prefers mass media. As in the study of Tran et al., the study population consisted of people who mostly obtained their health messages through the radio. Additionally, medical students work in the field of health; therefore, they can analyze and differentiate correct information from incorrect information. For this reason, access to scientific sources through the Internet can be helpful and facilitates their search for new information. Another point is that medical students have less access to television and radio when working in clinical departments, but they always have their mobile phones with them, and in fact, the common feature between mobile phones and health care providers is their "mobility." This creates a closer proximity between them.

In the second part of the study, we explored whether students' choices are influenced by temporal and age-related variables. The results showed significant differences in the use of health messaging apps, scientific sources, official sources of the Ministry of Health, Internet searches, mobile-based social networks, and informal verbal sources of health information across different age groups. The age group of 36 to

60 years old received more health information from scientific sources, while the age group of 26 to 35 years old relied more on mass media and Internet searches. Similarly, the age group of 18 to 25 years old obtained the most health information through Internet searches. Individuals in the age group of 36 to 60 years old, due to their greater scientific experience and maturity, are more likely to obtain their health information from scientific sources, while individuals in the age group of 26 to 35 years old, who are usually new to the work environment and have limited time, tend to rely on the Internet as a more accessible source of health information.

These findings are consistent with those of Wong et al. (35) and Li et al.'s (36) studies, indicating that age is one of the influential factors affecting how health information is obtained, and with increasing age, the level of experience and trust in health messaging apps is affected. These results were also in line with the findings of Moradi et al. (2018) (37), who investigated the relationship between social networks and health-related quality of life in adults in Tehran. The researcher stated that the use of health messaging apps was significantly related to age. However, these findings were not consistent with those of Forghani et al. (2018) (38), who aimed to investigate the effect of virtual social networks on lifestyle. The researcher stated that there was an inverse relationship between age and the use of health messaging apps. The results also showed that the use of health messaging apps differed significantly by field of study, in terms of official sources of the Ministry of Health, mass media, mobile-based social networks, and informal verbal sources of health information. Non-medical fields relied more on scientific sources, while clinical fields such as medicine and dentistry obtained their health information from official sources of the Ministry of Health, mobile-based social networks, and less from mass media and Internet searches. These findings were consistent with the results of Chen et al. (39) and Cotten et al. (40), who identified the field of study as one of the influential factors

affecting how health information is obtained. It is natural that non-medical fields would turn to credible scientific sources to ensure the accuracy of health information. However, students in clinical fields, due to their familiarity with clinical health information, have easier access to scientific sources such as professors and information transmitted in their clinical environment based on clinical guidelines. They also have a higher level of health media literacy and may prefer Internet searches as a source of information. In fact, medical and dental students can more easily verify the accuracy of scientific health information they find online, compared to non-medical students.

Additionally, the growth, development, and diversity of web-based applications have significantly increased the richness of the Internet media. Interactive web applications provide the ability to communicate through text chat or even video chat, allowing for the transmission of audio and visual cues, instant feedback, and the use of sound and images to create personal interactions. With these features, the possibility of delivering health messages to Internet users has been improved.

Another findings of our study was that the use of health messaging apps differed by place of residence. These results were consistent with the findings of Moradi et al. (2018), who aimed to investigate the relationship between social networks and health-related quality of life in adults in Tehran (37). In our study, it was found that students living with parents used mass media more than dormitory students. This could be due to the fact that these students have more access to television, radio, and newspapers, while dormitory students have to use shared facilities, and people's preferences for watching or listening to public media vary.

Based on the results of the present study, there was no significant difference in the use of health messaging apps by gender, but there was a significant difference in the use of scientific sources, official sources of the Ministry of Health, and mass media by

marital status. This finding is consistent with the results of Kulandairaj et al. (2014), who investigated the impact of social media on health behaviors such as nutrition, recreation, and physical activity (41), but not consistent with the results of Cho et al. (2014) and Asiri et al. (2018) (42, 43).

This researcher identified gender as one of the influential factors in receiving information. One reason for this inconsistency could be the type of population in the present study. In this study, the study population consisted of university students, and due to their similar education and equal access to information resources, gender could not be a determining factor. However, in other societies and the general population, gender may be a determining factor. For example, it can be said that housewives have more access to information due to their free time, compared to their husbands.

Limitations and Suggestions

This study was conducted with a large sample size of 500 participants and examined a diverse set of variables related to a relatively new topic. However, it was conducted in a large medical university and may not be generalizable to different communities or population groups. The study may also be subject to limitations related to sampling methods, sample selection, and potential uncertainties in the collected data.

Conclusion

Students prefer credible scientific methods and have wide and fast access to scientific resources. With the development of mobile devices as a facilitator of access to the Internet and scientific information, this trend is expected to increase. Therefore, attention to strengthening the media literacy of students is of great importance. Various contextual variables also influence the students' preferences in choosing media or messaging apps, highlighting the importance of health authorities' oversight of the credibility of health media. As the use of mobile-based resources, especially the Internet, is

increasing, it emphasizes the importance of government and health, treatment, and medical education ministries' oversight of the credibility of information published on the Internet. However, given the trend of the development of the virtual environment and the independence of individuals in accessing health information, perhaps the most important measure is to strengthen the media literacy of people in searching for optimal ways, identifying, and applying health information.

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Authors' Contribution

M.M participated in research design and data collection. Z.K was responsible for research design, data analysis and interpretation, and writing the article. NZ participated in research design, and critically reviewing the manuscript. All authors critically evaluated and approved the final article.

Conflict of Interest: None declared.

Ethics Approval and Participants Consent

We informed the students of the research objectives. All participants provided their consent by completing the informed consent form and answered the questions. The data were compiled and analyzed anonymously, and the results were provided to the relevant authorities. The ethical standards of the research have been approved by the National Ethics Committee in Biomedical Research under code SUMS.REC.1400.680

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A Review of the Book: Online Children and Their Right to Comprehensive Security in the Virtual Space

Khatoon Pourmaveddat¹, PhD; Zahra Karimian^{2*}, PhD

¹Department of Psychology, Payame Noor University, Tehran, Iran

²Department of e-Learning in Medical Sciences, Virtual School and Center of Excellence in E-Learning, Shiraz University of Medical Sciences, Shiraz, Iran

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*Corresponding author:
Zahra Karimian, PhD;
Department of e-Learning
in Medical Sciences, Virtual
School and Center of
Excellence in E-Learning,
Shiraz University of Medical
Sciences, Shiraz, Iran
Email: Karimian@sums.ac.ir

Introduction

Today's children are the digital native generation and owners of the virtual space. With advances in technology and increased use of the internet, children are increasingly present in the virtual space. However, like any other phenomenon, the virtual space presents numerous challenges for children. Considering the importance of children's rights in the virtual space, the author aimed to examine this topic from various dimensions. In this review, we analyzed and reviewed one of the books that examine children's presence in virtual spaces from a legal perspective (1):

Book Title: "Online Children and Their Right to Comprehensive Security in the Virtual Space"

Author: Mohammad Mehdi Badami with the supervision of Mohammad Abdolsaleh Shahnoush

Publisher: Research Institute of the Judiciary (Tehran, Iran), Center for Printing and Publishing of the Research Institute of

the Judiciary

Language: Persian; Publication year: 2020

Thesis

The book "*Online Children and Their Right to Comprehensive Security in the Virtual Space*" addresses the issue of children's presence in the virtual space in six chapters and 128 pages. The book, which is also described in the introduction, moderately and debate-like, examines the positive and negative dimensions of the virtual space for children from the perspective of "rights". Although this book is written from a legal perspective, given the interdisciplinary nature of the subject of children in the virtual space, it can also be studied and considered from psychological and educational perspectives, as well as in schools and the virtual space. The author discusses the virtual space for children as a right and examines the positive and negative consequences of children's presence in the virtual space.

Book Body

In the first chapter of the book, the author discusses the concepts and characteristics of the virtual space in two speeches. In the first speech, the author introduces the concepts of violence and security in the virtual space. Although the concept of "security in the virtual space" is implicitly derived from the United Nations Development Program report (1994) (2), and the concept of "violence in the virtual space" is derived from the Global Report on Violence and Health (3), perhaps the most ambiguous definition in this regard is the concept of "child". The author mentions that determining the age of a child in the virtual space has not yet reached a collective convergence in legal sources. In addition, in Islamic texts and the laws of Iran, the issue of the legal age is also discussed, according to which the legal age is less than 9 years for girls and less than 13 years for boys. The age definition is one of the main challenges for regulation in the virtual space due to children's widespread access to diverse content. Furthermore, the author has addressed the characteristics of the virtual space. The four major factors include widespread access, the speed of information transfer, the irreversibility of information, identity concealment, and the permanence of information published in the virtual space, all of which exacerbate the consequences of children's data dissemination and misuse in the virtual space (1).

In the second chapter, the author considers children's presence in the virtual space as a right and examines it from the dimensions of the right to freedom of expression, the right to education and learning, the right to civic participation, and the right to children's health. Since in international human rights texts, the "right to freedom of expression and thought" is referred as a civil and political right (4) for human beings, this right also exists for children, and they cannot be prevented from accessing the virtual space. The author refers to Article 19, paragraph 2 of the International Covenant on Civil and Political Rights, which includes freedom of search, reception, and

dissemination of any opinion (5). In addition, Article 13 of the Convention on the Rights of the Child states that "Children must have the right to freedom of expression, and presenting their ideas in any form, written, oral, or any media, without limitation, is possible" (6). Also, the 12th paragraph of the Universal Declaration of Human Rights states: "Everyone has the right to a private life, free from interference by others, and no one has the right to arbitrary interference with their self, family, or communications" (7), and in Article 17 of the International Covenant on Civil and Political Rights, it is prepared: "No one shall be subjected to arbitrary or unlawful interference with his privacy, family, home, or correspondence, or unlawful attacks on his honor and reputation" (8). Although at first glance, the virtual space may seem to provide the grounds for the disclosure of individuals' privacy, some believe that the concept of privacy in the virtual space and the real world are different from each other, and unlike the real world where privacy is the main principle, in the cyberspace, the principle is the dissemination of information in the public space (1), and in fact, it is this public nature of individuals' privacy that leads to the development of access to information and increasing awareness. The author refers to the impact of the virtual space on educational justice and creating access to education and learning for all children, especially disadvantaged children, by providing evidence from developing countries. The existence of e-books and online infrastructure has provided access to education and learning for children, especially underprivileged girls (1).

Chapter three of the book discusses examples of violence and violation of children's rights, including sexual exploitation of children in virtual spaces, child pornography, cyberbullying, and violence in online games. The most significant challenge highlighted in this chapter is children's unawareness of the risks associated with sharing private information, which creates a platform for exploitation and cyberbullying (9). The

author also discusses the sense of shame and humiliation experienced by children from sharing personal information and images, as well as depression resulting from rejection or ridicule by peers at school, which are among the consequences of violence in virtual spaces for children, even leading to suicide (10).

Chapter four examines the role of parents, government and non-governmental organizations, coaches, and teachers in protecting children in virtual spaces against instances of violence towards them (11). The author emphasizes the importance of paying attention to regulatory laws that protect children, citing international treaties and conventions. The Convention on the Rights of the Child explicitly addresses the role of legal and psychological counseling for children and their families as primary prevention and mitigation measures against the consequences of virtual violence. The author then examines the relevant laws on violence in Iran and the world, suggesting that many countries, both developed and developing, are focused on the issue of violence in virtual spaces and the need to pay attention to children and schools in this regard. It seems that the laws of Iran need serious revision in regulating these laws.

In chapter five, the author reviews the new laws of different countries regarding the protection of children's rights and presents practical experiences from the United States, Europe, and other developing countries regarding punitive measures against violence. In addition to legal and regulatory measures, family empowerment, child awareness-raising, infrastructure policies, and digital literacy are among the measures discussed (1).

Finally, in the last chapter, the author reviews practical solutions for controlling and preventing violence against children worldwide and examines Iran's actions in this regard. The author cites some measures, such as providing the National Information Network, which calls on all countries, including Iran, to regulate laws on virtual violence and explain its examples.

Conclusion

The presence of children in the free virtual space has always been a concern for parents, schools, and governments. Virtual space provides equal access for everyone, regardless of location and time, by creating access to information and facilitating the promotion of individuals' awareness and the convergence of thoughts. However, the endlessness of information and the lack of control over access to it always poses threats to children. Therefore, the question of whether virtual space is a right or a threat is always challenging. This book highlights the positive and negative consequences of virtual space from a legal perspective, drawing the attention and support of all individuals involved with children, including parents, teachers, education officials, psychologists, and governmental and non-governmental organizations to pay attention to and protect children in virtual space against violence. It seems that this book has been successful in expanding the conceptual understanding of this issue and providing evidence of the actions taken in this regard to help program planners and responsible educators of children.

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Health Literacy for Black Community Leaders Using “Responsible Hearts” Program Virtual and Onsite Educational Interventions in Three Colombian Municipalities

Leany Blandon^{1*}, BSND, MA Student;  Juan Carlos Santacruz², BSc

¹Collective Health, Nursing School, University of Antioquia Deputy Scientific Director Colombian Heart Foundation, Bogota Colombia

²Colombian Heart Foundation, Bogota Colombia

ABSTRACT

Cardiovascular diseases are the number one killer worldwide, with 17.9 million deaths, and in Colombia, with 19,000 in the last quarter of 2022 (accounting for 30% of deaths). Despite healthcare services and educational programs, the epidemiology continues to grow steadily. *Method 10 of Care as a Lifestyle*, created by the Fundación Colombiana del Corazón (FCC) [Colombian Heart Foundation], aims to raise awareness to impact the perception of change and generate confidence to begin the pre-contemplation stage in peoples’ behavior, building a solid educational basis for introducing the concept of collective health to the community using simple and inclusive language, and adopting technological advances as a teaching medium. This refers to ludic and inspiring activities which help promote behavior change which aimed at building care into peoples’ lifestyles. The FCC proposes it as an apt pathway for preventing and/or reducing the incidence of cardiovascular disease by directing their actions more precisely toward clinical and social risk factors.

Keywords: Distance, Health literacy, Collective health, Public health, Health education, Lifestyles, Cardiovascular prevention, Cardiovascular disease

*Corresponding author:

Leany Blandon, BSND, MA Student;
Colombian Heart Foundation,
Bogota Colombia
Tel: +57 3146144859
Email: lblandon@corazonesresponsables.org

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Problem

Despite the indisputable increased coverage of healthcare services and the development of health literacy programs, cardiovascular diseases continue to be the main cause of death, with an ever-growing incidence. This is an epidemiological reality to which the world is facing today and these figures, which are already dramatic, are expected to increase an alarming 40% by 2035, if immediate action is not taken (1).

Being aware of the shortcomings in health education and literacy strategies for preventing cardiovascular diseases, the Fundación Colombiana del Corazón created

the Responsible Hearts Program in 2010 as an action strategy for achieving health literacy among the Colombian population.

The FCC Responsible Hearts Program’s care as a lifestyle aims to teach people to take action to care for their hearts, adopt care as a lifestyle, learn to talk with their physicians, identify early signs and symbols of lifestyle-related diseases (especially cardiovascular diseases), learn ways of accessing the healthcare system, and choose healthy behaviors.

Throughout these years, FCC has structured a communication and education strategy for creating on-site (through educational events

and projects) and virtual community settings using WhatsApp groups (for community projects), a web page (2), YouTube (3), Instagram (4), Facebook (5), and a Virtual Campus (6). These communication strategies are intended to draw the participants closer, expand coverage, and provide them with valid tools for accessing knowledge. The FCC is aware that the use of information technology, and especially text messages, is effective, as shown in the systematic review by Hall, Cole-Lewis and Bernhardt in 2015 (7).

Since 2021, FCC has been carrying out various educational interventions which aimed at fostering health literacy by encouraging knowledge appropriation and transfer using specific educational strategies. As a result of this commitment, two training programs have been implemented with Black residents of Colombian towns. In 2021 (8-10), in the municipalities of Apartadó (Antioquia), Cartagena (Bolívar) and Montería (Córdoba) and, more recently in 2022, in three other municipalities (San Andrés, Barranquilla (Atlántico) and Tuluá (Valle del Cauca), where a concrete formative approach strategy was employed. The educational components are recorded in the “Care as a Lifestyle” program, which is FCC information-training strategy. The essence of the intervention was to provide elements to support the leaders’ everyday decisions, to motivate them to commit to simple lifestyle changes and become teachers

in their settings to achieve health literacy in their communities.

Solution

To achieve the 2022 training proposal, alliance was made with Universidad Simón Bolívar and the Chambers of Commerce. Community leaders who were recognized by their communities were invited to participate. The intervention focused on Black people due to the differential incidence of cardiovascular disease found in research studies (7), and the three municipalities were chosen as part of a population coverage strategy.

The eight-month educational intervention in 2022 targetted 480 leaders in the selected municipalities, and the axis of the academic content of the training was the 10 cultures that made up the programmatic axis of the care as a lifestyle strategy of Fundación Colombiana del Corazón’s Healthy Hearts program. (Figure 1) Four onsite workshops were conducted in each city and pedagogical training complements were carried out throughout the eight months using the web microsite virtual tools as well as the WhatsApp groups formed in each municipality Program (11).

Results and Conclusion

The analyses were done using Stata 14.0 with a two-tailed level of significance of <0.5, which was considered statistically significant. All the information collected



Figure 1: Method 10 of Care as a Lifestyle

throughout the study from analytical data as well as sociodemographic and psychological questionnaires was consolidated and validated to ensure the quality of the entered data. Multivariate association analyses using linear regression were conducted for each of the dependent variables.

In order to evaluate the impact of the intervention on the intervention population's knowledge acquisition in 2022, we applied three tools:

The first tool was the Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL) scale. Significant differences were found in various questions related to "smoking is a preventable cause of death and diseases in our country", "hypertension medications should be used for life", and "there is a risk of heart disease if the good cholesterol (HDL) is high." These answers had the greatest difference between the two applications, with $P < 0.001$. It is also important to highlight that, for most items, the answer option of "I don't know" decreased 10% on the final application compared with the initial application of this tool. Likewise, there was a 15% increase in knowledge and identification of the cardiovascular disease risk factors, as well as a more than 30% increase in correct answers between the admission and discharge surveys of the training intervention, generating relevant clinical significance.

The second tool evaluated the impact of the Responsible Hearts strategy on each of the participants. To the question, "How would you rate the workshops you attended in the four interventions?", more than 80% responded positively in the three study groups.

The third tool was the analysis of a case study consisting of nine questions. According to the results, the overall population had a 75% learning index based on the statistics of correct answers selected after the analysis was carried out by each of the participants in the training workshops.

One of the key elements through which the methodology of onsite workshops was consolidated and complemented was the creation of WhatsApp communities,

one per city, through which tips, recipes, commitments, opinions, graphics, tutorials, presentations, motivational examples, testimonials, educational information, and life experiences were shared each week for six months.

Health and Collective Health Literacy as an Essential Tool for Impacting Cardiovascular Health

Achieving *health literacy* means increasing a person's ability to access, understand, and use information to help him/her maintain good health (12). In the implementation of community interventions, FCC has found that while people have varying percentages of knowledge on lifestyles for preserving health or managing identified risk factors, they lack motivation, confidence, and/or empowerment to adopt healthy behaviors. The main objective of FCC community education interventions is to transfer knowledge easily using assertive and motivating language. Information on the risks, perception of risks, and knowledge of what behaviors protect health are essential factors in people incorporating care into their lifestyle. This strategy was adopted in line with the transtheoretical model of change and includes aspects of the theory of planned behavior (TPB) (13).

The findings of the 2022 intervention in the three target study municipalities reinforced the importance of promoting community and population strategies and interventions aided by technology to increase the knowledge and perception of the risks, different ways of managing them with small lifestyle changes, identification of personal commitments and having community leaders to become teachers in their living situations within vulnerable populations.

The construction of teaching elements which aimed at stimulating a step-by-step change in the psychological path from pre-contemplation to action was the basic guarantee supporting the success of the intervention designed for communities whose cultural construct is focused on sedentary behaviors and eating foods which are high

in sodium, sugar, and saturated fat.

The FCC emphasized three key aspects of care as a lifestyle educational program intervention: the use of a new language in daily life, use of persuasion toward new behaviors based on actual possibilities in the cultural context, and creation of a connected peer community sharing experiences, successes, and questions.

The intervention was able to reinforce the knowledge of risk factors and empowered people to achieve change, appropriate the Responsible Hearts teaching strategy, choose more natural and less processed foods and, finally, acquire knowledge of the signs and symptoms of cardiovascular disease.

Lifestyle educational interventions, involving people as subjects of change, are a huge opportunity using care-based strategies to help improve the quality of life and produce good living conditions, prompting behavior changes that have the proposal of care as their essence. This type of intervention, can change the future of community leaders, their families and the community.

Authors' Contribution

LBR: conceptualization, study design, experimentation, data collection, statistical analysis, manuscript preparation; JCS: conceptualization, study design, experimentation, data collection, statistical analysis, manuscript preparation;

Conflict of Interest: None declared.

Ethical Considerations

The authors also state that consent was not obtained by coercion and the participants had the option of withdrawing at any stage of the research.

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